The
Electrical Review

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Electrical Prosperity

THE confidence that has always characterised our predictions regarding the electrical industry is again being very fully justified in these days.

While other national industries faced a prolonged slump period, the electrical industry, thanks partly to the grid, was able to hold its head up. When the grid contracts fell away it suffered from depression, but that depression was lessened by domestic expansion, and to-day we may congratulate ourselves that the fall in the curve was briefer than might have been expected, also that we are now enjoying definite prosperity, employing more people than ever before in our history and expecting to go on meeting still further increasing demands.

During the past few weeks manufacturing companies have issued very satisfactory statements and returns relating to their trading operations during 1934. In our issue of February 22nd we quoted the larger profits earned by several companies, and since that date we have recorded increased activity, turnover and profit on the part of electrical manufacturing, cable, telephone, elevator, aluminium, insulating varnish, and other concerns.

The volume of trade and the resultant profit have both grown substantially; dividends have been resumed in some cases and increased in others. Associated Electrical Industries, the British Thomson-Houston Co., British Insulated Cables, English Electric, Ericsson Telephones, British Aluminium, Pinchin Johnson, and others have all had the same sort of story to tell.

At the meetings of some of our companies a year ago stress was laid upon the necessity for competing manufacturers to co-operate in the control of excessive productive capacity. Mr. M. J. Railing, in his address as chairman of the B.E.A.M.A. Council, referred to the same subject. He pointed to the indications then present of revival on the heavy engineering side and to the welcome signs of improvement both in conditions throughout the British Empire and within the electrical industry. These remarks may be recalled now that we have the review of another year's work before us; he spoke last year of the good that had been achieved by welding together relationships within the Association, leading to better understanding, and he urged all to co-operate in solving the difficulties within their own house and to present a united front to those outside it.

In the report upon which he based that speech, the Council, with its usual caution, told us that "the prospects for a gradual trade improvement were by no means gloomy, and that we might even look with some confidence to 1934 witnessing the final passing of the nightmare of industrial depression."

In the report adopted last week and abstracted on page 454, it is far happier and more positive, for it not only finds that events have justified its "forecast" of a year ago of a "distinct upward tendency" in output of products but it notes also that indications of the present year point to continued improvement. It even goes so far as to find signs that 1935 will be a prosperous year for the industry. It is many a long day since we found such optimism in a B.E.A.M.A. Council report; this new forecast should, on that account, be the more acceptable and encouraging.

Mr. M. J. Railing, before retiring from the chairmanship of the Council in favour of Mr. J. A. Hirst, reviewed the present position briefly at the annual meeting, and his remarks regarding increased electrical employment, the rapid rise in production of machinery and apparatus, and the demand for domestic appliances were most gratifying. He relinquishes his important office with the knowledge that the "general outlook" is "brighter than it has been for some years."

Fair Trading This Year?

As the Fair Trading Council shelters beneath B.E.A.M.A.'s roof, and Mr. Dunlop, a director of B.E.A.M.A., is its independent chairman, it naturally receives attention in the Association's annual report. The optimism which pervades the report extends in this particular direction, for it is stated that negotiations which are in progress with the supply authorities

are hoped to reach a satisfactory conclusion at an early date. Indeed, there is "satisfaction throughout the electrical trade that a fair trading policy is to be put into operation during the year." It would certainly clear the air for the National Convention if such a devoutly wished consummation could be brought about before June. At any rate, it is expected by some that the requisite spirit of accommodation will be engendered by the Convention.

Three-phase to Two-phase

THE vogue for the two-phase method of distribution was short-lived, but it left behind several useful and extensive networks which are now usually supplied from three-phase systems. For bringing about the change from three to two-phase, or even *vice versa* when the higher efficiency of the three-phase motor makes this worth while, the Scott-connected transformer still holds its own as easily the best static apparatus for the purpose. The principles underlying its operation remain as important as ever, but we find they are not always fully comprehended. Mr. H. P. Young in this issue presents them in a manner that should be useful to many who are responsible for phase transformed systems. A more modern application is for the supply of current to single-phase furnaces from three-phase distributors especially when two of these have to be balanced on different phases. As standard designs can be adapted for the Scott connection and the main and teaser units can be made interchangeable, flexibility is possible without appreciable addition to the cost.

Power Factor

MR. E. W. DOREY was, we think, on safe ground in prophesying to the A.S.E.E. that all undertakings supplying a.c. would soon introduce a power factor tariff. The tendency to do so will be expedited by the purchase of bulk supplies from the grid under a penalty for power factors below 0.85 lagging. The practice nowadays of installing motors of a rated horse-power near the actual load and taking advantage of the overload for peaks, together with the use of higher-speed machines, should make even more difference. Power-factor correction at the load provides scope for considerable technical ingenuity, whereas the transmission of wattless current merely introduces voltage-regulation troubles. The advantage of the tariff based on kVA of maximum demand is that it avoids those elaborate explanations (often made by some not altogether happy analogy) to the consumer. All that need be told (and it certainly should be told) to the industrialist is that he can reduce his m.d. charges by installing apparatus up to a point at which the additional capital charges are outweighed.

E.D.A.'s Money

THE Publicity and Campaign Committee of E.D.A. does not impress us as being the strongest of its individual groups. Yet unless we misunderstand the main purpose of the Association it is its most important. We are, of course, not referring to its personnel, for the membership includes some very live wires, but to our impression of what it has been able to do as the result of seven meetings held during 1934. The lengthy reference in the Council's report to advertising campaigns related mainly to something which ended in July last, or something else which started in "a comparatively inexpensive way" in November. The detail of the review strikes one as being altogether out of proportion to the achievements so far as one can judge them. One is inclined to wonder whether the Association has yet been able to make up its mind on this matter of advertising—where it ought, and where it ought not, to appear. It may be, and we think is, perfectly legitimate for the electricity supply industry to support large special supplements in outstanding organs in order to impress London investors, the City and the Stock Exchange, but after all is that the purpose for which E.D.A.'s funds are subscribed, whether fifty per cent. of them come from the Central Board or not? Is not the money meant to be used in ways that will so influence the mind of the people and of the industries that they will more rapidly become big consumers of electricity?

Local I.M.E.A. Groups

WE have received from the secretary of the I.M.E.A. an official statement concerning the great increase that has taken place in the work of the organisation in recent years and the benefit that undertakings derive from its operations. These circumstances have led to the formation of a number of local centres—the Mid-East England, Scottish, and North-East England centres are already functioning, and the formation of one for the South-East and East England area was recently decided upon, particulars of which appear on a later page. The real reason for the existence of these centres is that when problems arise peculiar to undertakings in particular areas and local in character, the special interests of these undertakings can be studied by those thus appointed and representations made to the I.M.E.A. Council if necessary. The areas covered by the centres are those defined by the Electricity Commissioners under their various schemes.

Automobile Electrical Troubles

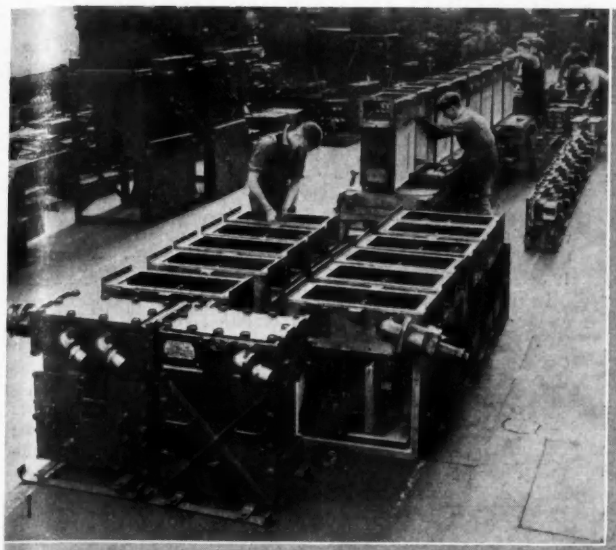
THE report on the causes of breakdowns of motor vehicles during 1934, based on figures obtained from its "Get You Home" service for members, has lately been issued by the Royal Automobile Club. This shows that engine ignition trouble continue to be far and away the most prolific cause of breakdown, and, although most of the trouble may be due to lack of attention on the part of motorists, the point is one that manufacturers of such devices ought to take into consideration. As a matter of fact, although the proportion of breakdowns due to ignition faults during the past five years has varied only a few decimal points above 20 per cent., there was an increase last year from 20.2 in 1933, to 21.2 per cent. The electric starting equipment of motor vehicles, on the other hand, may be regarded as satisfactory, its failure having been responsible for only 1 per cent. of breakdowns, as against 1.2 per cent. in 1933. The electric lighting of cars also functions well on the whole, the failures under this heading declining from 2.9 per cent. to 2.4 per cent. last year. No separate mention is made of automobile batteries.

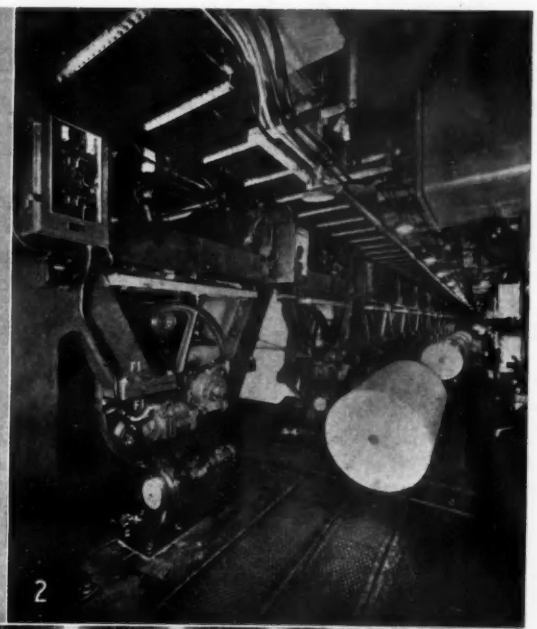
The National Register

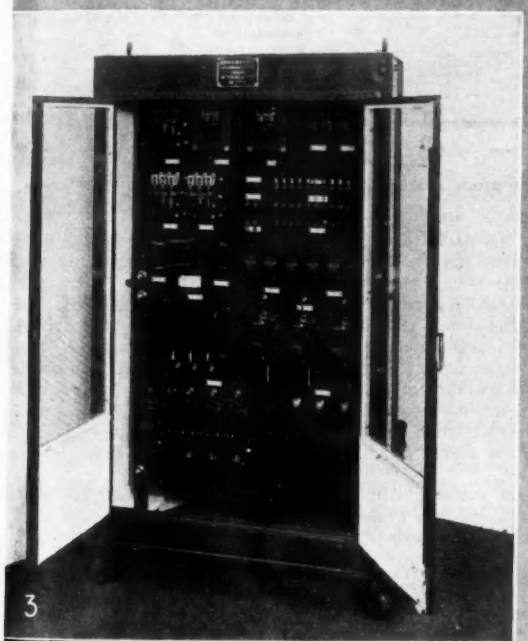
ON another page we review the 1934 report of the National Register of Electrical Installation Contractors which shows that although the revenue has been augmented by the raising of the annual fee the receipts from this source are still insufficient to cover the normal working expenses. This is due to the cost of the inspection service which was inaugurated in 1933. Undoubtedly inspection has proved its value in keeping the registered contractors up to scratch and weeding out unsuitable applicants for enrolment. This service must be maintained, and even strengthened if the Register is to be truly representative of sound installation work.

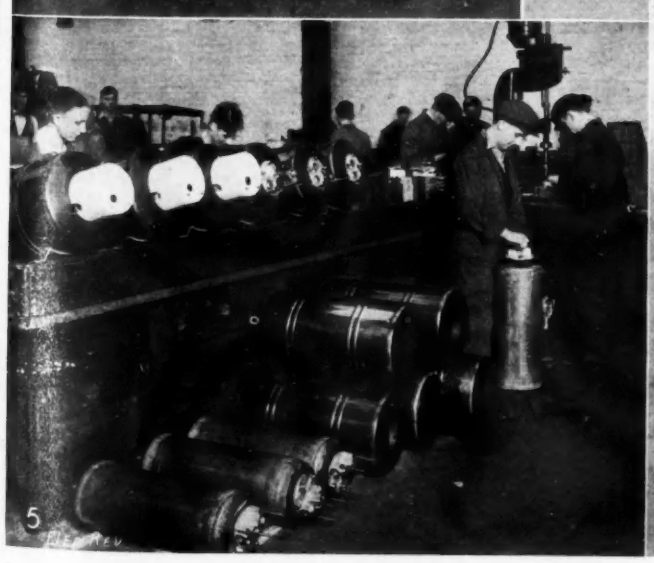
International Tendering

THE two plenary meetings of the International Electrotechnical Commission to be held at The Hague and in Brussels towards the end of June will include discussions by seventeen advisory committees regarding the practicability of reaching common agreement in many technical aspects, from lamp caps to the rating of electrical machinery We have everything to gain from this extension of the work of the British Standards Institution (which provides our national committee for the I.E.C.) into the international sphere. An equitable basis of tendering, coupled with a reduction in the variety of component parts, that still leaves scope for invention and originality in design is very desirable.







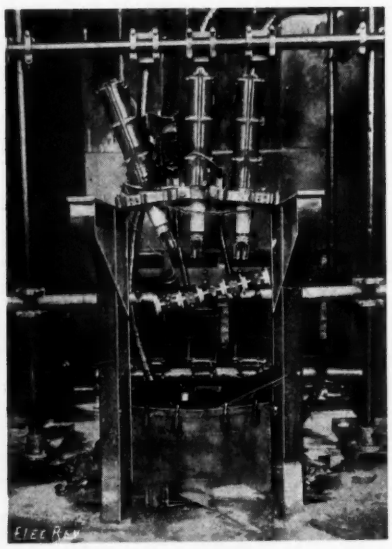


Views of Messrs. Reyrolle's Works and Products. **(See next page)**

1. Assembly bay for air-break mining switchgear. 2. Reel-stand equipment fitted to newspaper presses. 3. Control panel for commutator motor press-driving equipment. 4. A group of welding sets. 5. Domestic water heaters being assembled at the New Town Works. 6. The assembly of 10/35-kW l.v. electrode steam raisers

Tyneside Activities

IT is now more than five years since the Hebburn short-circuit testing station, which was described by Mr. H. W. Clothier in our issue of May 30th, 1930, was brought into service. During this time about 4,000 tests have been carried out, many of which were of the duty-cycle type comprising two or more short-circuits at definite time intervals. The general objects of these tests are: (1) the proving of standard productions; (2) design development; and (3) research on circuit making and breaking, and correlation with supply - system conditions of severity.

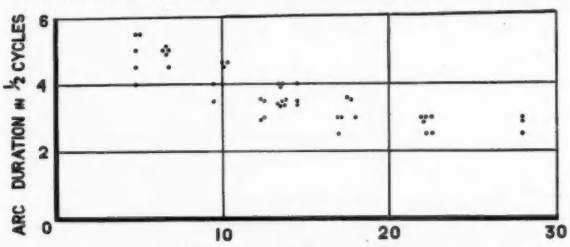


A test to destruction

The experience gained has emphasised the need to carry out tests at normal load and at 30 per cent., 60 per cent, and 100 per cent., of the breaking capacity of the switchgear to establish its rating.

Last year a second 1,500,000-kVA Parsons alternator (which runs in parallel with the other machine when required), driven by a 1,600-h.p. three-phase 5.5-kV motor, with other ancillary apparatus, was installed, making the plant the largest of its kind in the world. The new equipment is an exact duplicate of the first, and incorporates standard metal-clad bus-bars, indicating the sound engineering lines on which the original scheme was laid down.

Any voltage required for testing breakers up to the largest size manufactured, from 440 to 156,000 single-phase, or 132,000



Arc duration characteristic of high gas pressure o.c.b. rated at 150 MVA, 11 kV

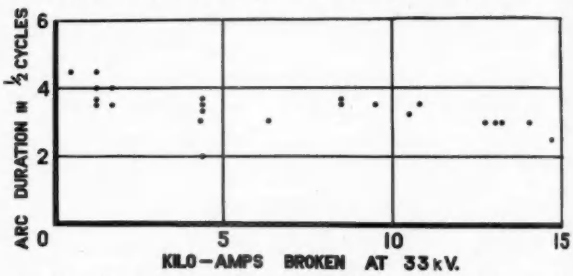
three-phase, is obtainable from the alternators or from the alternators in conjunction with transformers. Reactance-coils and resistances give a large range of short-circuit currents at variable power factors, although the normal is 0.1. The highest equivalent three-phase kVA at 50 cycles based on the resultant of a.c. and d.c. components and current for assymmetrical kVA is 3,000,000, and on a.c. components only for symmetrical kVA it is 2,300,000.

On the occasion of the visit of the N.E.S.C.O.E. Association on March 19th, Messrs. Reyrolle & Co., Ltd., staged a demonstration of the effect of electromagnetic forces due to the passage of current in conductors of the "open" type, indicative of the need for strong rigid fixings such as are used for the compound-filled metal-clad gear of the company. As the test current was about a quarter of the asymmetrical peak current output of the station, the forces exerted were only about one-sixteenth of those set up under a maximum current test, but the results were quite impressive enough.

The test also showed the power of the arc which is formed when contacts separate on short circuit and which has to be controlled by a circuit breaker. The short circuit applied was at 6,350 V single-phase, the peak current being 130,000 A, which is the asymmetrical value corresponding to 1,000,000 kVA at 11 kV three-phase. The duration of the arc was about 12 cycles before the weak link of the copper strap disintegrated.

In the adjoining workshops, a large number of welders were at work, principally in the fabrication of steel frames for kiosks and of circuit-breaker tanks and supports. The electric arc was being used for cutting plates of thicknesses for which the oxy-actylene flame used to be considered more suitable.

The "Eureka" vacuum-cleaner was to be seen in various stages of manufacture, and among the other products of the company in various stages of construction were Holmes equipment for rotary printing presses, cartridge fuses, the "Reyvaux" off-peak load-control unit, metal-clad distribution gear, and high- and low-voltage electrode water heaters, ammeters, voltmeters, and indicating instruments.



Arc duration characteristic of turbulator o.c.b. (750 MVA, 33 kV)

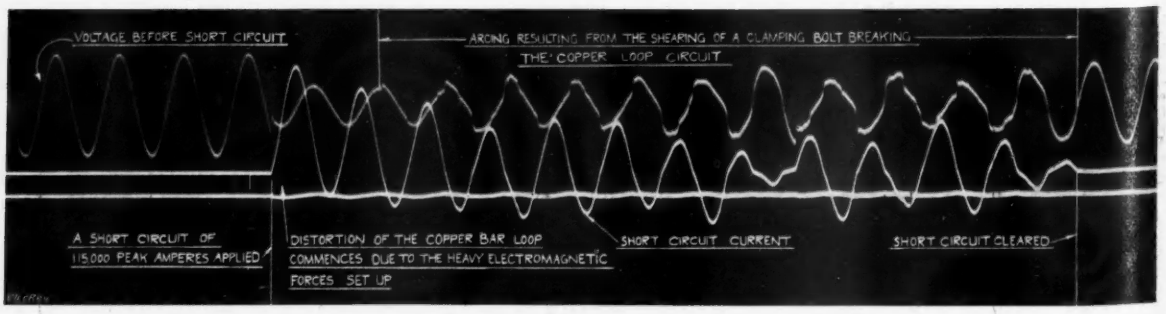
The exhibits that attracted the most attention, apart from the short-circuit test, were the working models of the various Reyrolle protective systems. A good example was the split-pilot panel for instantaneous tripping on overload with short-time-delay directional backing, in which the interlock is obtained with a telephone pair. This has the advantages of the Merz-Hunter scheme without the need for a special form of switch and is reliable when an internal fault arises at the far end.

Developed originally for use in connection with the grid, the ratio-balance system has been applied to other overhead transmission systems, the length of which renders the provision of a pilot too costly; it is a form of reactance time-distance protection. For network control, directional over-current protection, in which the time is graded in half-second steps from point to point, provided another subject of interest.

In the afternoon the first visit was to the Dunston 50-cycle 150,000-kW power station. This was started up just over two years ago and was described in our issue of February 10th, 1933. It is still operated at a poor load factor owing to the conditions created by the change-over of the North-Eastern Electric Supply Co.'s system from 40 to 50 cycles, but we see no reason to doubt that when it can be used as a base-load station, it will justify the confidence in its potentialities entertained by the staff.

There is a local control room at Dunston, from which the grid point there is also operated, but the main control of the system of 5,620 sq. miles with its 12,000 sub-stations, is centralised at the head office at Carliol House. This has been altered only in detail since it was described by us on February 10th, 1933.

The holding of the fourth annual dinner and reunion of the


VOLTAGE BEFORE SHORT CIRCUIT
ARCING RESULTING FROM THE SHEARING OF A CLAMPING BOLT BREAKING THE COPPER LOOP CIRCUIT
A SHORT CIRCUIT OF 115,000 PEAK AMPERES APPLIED
DISTORTION OF THE COPPER BAR LOOP COMMENCES DUE TO THE HEAVY ELECTROMAGNETIC FORCES SET UP
SHORT CIRCUIT CURRENT
SHORT CIRCUIT CLEARED

Oscillogram of a copper loop circuit (2½ in. by ¼ in. bar) broken by destruction of clamping bolt

Lighting in the Textile Industry. By J. W. Howell

Economic effect of the scientific illumination of beams

VISITS to several spinning sheds in Lancashire have left the impression with me that little is understood generally in the cotton industry of the value of scientific lighting in the beaming processes. The accompanying illustration of a warping room showing lighting by the drop pendant system is typical of those visited, and is quite unsatisfactory from an illumination standpoint, poor distribution being accompanied by excessive glare.

The beaming process consists in winding the warp from spools on to beams ready for transfer to the weaving looms; this necessitates good lighting at the spool table, the "gatherer in" and the cross staff where tension is applied to ensure even winding. A large number of spools are mounted on the frame, and one of the duties of the beamer is to see readily when the spools are empty and require renewing. The beam has then to be stopped, new spools mounted and the threads joined.

Unsatisfactory lighting

An Undesirable System

A favourite method is to place unshielded clear lamps behind the frames, and the beamer thus gets the full glare from the lamps in addition to the doubtful benefit of easy detection of thread exhaustion on the spools. In one instance the management was persuaded to remove the glaring lights at the rear during the lunch interval and to alter slightly the position of other lamps so as to give light from the front. It was not surprising to learn that no complaints were made; in fact, the improvement was acknowledged by the beamer concerned.

The process of beaming is, of course, common to textiles in general, and it can be easily shown that the better quality of the warp the more it responds to lighting which has strong directional characteristics. Jute reacts to a far less degree than cotton, while silk and rayon will give even better results than cotton. Good lighting facilitates machine adjustment, spool changing, thread joining and unknotting, and the speedier detection of the necessity for the operation results in stoppage time being considerably reduced. Tests proved that the machine efficiency is considerably increased with a corresponding increase in output and that there is also a material improvement in the wound yarn.

The tests were carried out on four beams operating normally on pure silk and rayon, the beamers having had from two to five years' experience. Originally the lighting consisted of two 40-W drop pendants, the improved conditions being obtained from three levels of illumination given by general overhead lighting using standard dispersive reflectors and, secondly, by using uni-directional lighting of various illumination values. An analysis of the stoppages of the beams showed that 42 per cent. of these were due to spool changing, while thread breaking and unknotting accounted for a further 32 per cent, both of which operations can be speeded up by correct lighting.

Extent of Improvement

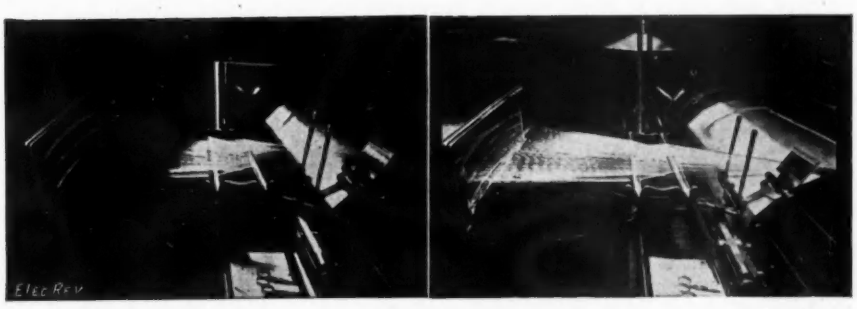
Working on 500 W per beam for both systems of improved lighting as against the original 80 W, it was found that the total number of stoppages increased 2½ times for general lighting and 3¼ times for directional lighting. This was due to the easier detection of faults, and need of spool changing. While a far greater number of stoppages occurred, due to the increase in speed of correction, spool changing was speeded up 15 per cent. under the first system and 17 per cent. with the latter. Similarly, the increased speed of correction for thread breakage, &c., was 22 per cent. and 23 per cent., respectively. This meant a considerable reduction in the number of faults creeping through into the wound beams in addition to an increase in production of 25 per cent. under general lighting and 32.5 per cent. with directional.

For the following comparisons energy costs have been worked out on the average charge for industrial purposes shown in the Electricity Commissioners' Report for 1932 the tariff being at the rate of 0.8d. per kWh. Lamps and fittings are charged at the current list prices, the lamps being required to conform to the requirements of B.S.S.161-1934, as regards their life of 1,000 burning hours. Working periods under artificial illumination have been assessed at 400 hours per year, which corresponds approximately to the yearly lighting period of an average single storey shed with "north-light" roof. Depreciation has been spread over a period of five years and on-costs assessed at 150 per cent. of the beamer's wage at current rates, and no efforts have been spared to make the final results as conclusive as possible.

Convincing Figures

Taking the wattage per beam as 500, the value of the increased product with general lighting is £5 per year, while the total increased cost entailed to obtain this higher output is £1 14s. per annum; thus the better lighting paid for itself three times over, showing a net profit of £3 6s. per beam. Directional lighting gave an even more convincing result with an increased output value of £6 5s. and increased costs at £2 5s., paying for itself three times over and giving a net profit of £4 per beam per year. The additional costs entailed by installing directional lighting showed a benefit due to increased output alone of 14s. per year even over the standard dispersive system of lighting. Furthermore, it appears that still further monetary benefits result from the use of even higher levels of directional lighting, while with general lighting the maximum benefit appears to be obtainable at about 400 W per beam.

Only the profits produced by increased output have been taken into account. If it had been possible to include improved quality figures, the net profits would have been substantially increased.



Left: The cross staffs under the original drop pendant system which gives bad distribution and fails to light the "gatherer in" on the left-hand side. Right: The same position under directional lighting, light being available over the whole working surface

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Tyneside Activities *(continued from previous page)*

N.E.S.C.O.E. Association at Newcastle-on-Tyne on the same evening was thoroughly justified by results. The attendance was considerably larger than on previous occasions and included many of the present members of the Newcastle Co.'s staff. Mr. R. P. Sloan (president) occupied the chair. The toast of "Our Guests," proposed by Sir Arnold Gridley, was responded to by Mr. H. A. Couves (director and general manager of the company), and Mr. J. R. Beard proposed the health of the chairman. All were in reminiscent vein, as were many others at a later stage, Mr. Briggs carrying his memory back over forty years to the genesis of the company's operations.

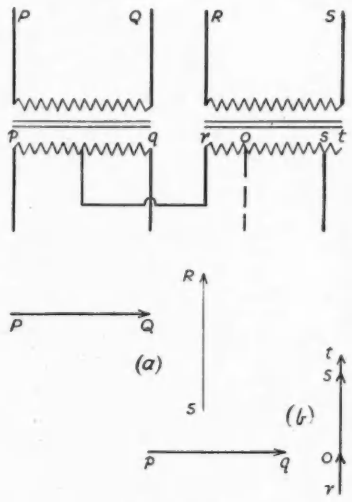
A special request was made that information relating to the movements of former employés of the old Newcastle and allied companies should be sent to the hon. secretary, Mr. W. G. Bass, 506, Bush House, W.C.2.

Scott-connected Transformers. By H. P. Young, M.I.E.E.

A presentation of the underlying theory

THE Scott system of transforming two-phase to three-phase e.m.f.'s, and *vice versa*, is universally employed for this purpose, but my experience is that the theory of the system presents considerable difficulties to the student.

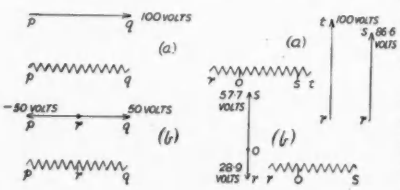
Fig. 1 shows the connections, where PQ and RS represent the primary windings which are connected to a two-phase supply. The voltages applied to the primary windings are shown vectorially in fig. 2 (a) and the corresponding secondary voltages in fig. 2 (b). Strictly speaking, rotating vectors can only be drawn to represent maximum values, but since r.m.s. values are maximum values multiplied by a constant, the vectors can be regarded as representing r.m.s. values; PQ, RS, pq, and rt, i.e., represent in length 100 V r.m.s.



Figs. 1 and 2

Now, a vector quantity is specified by magnitude, direction and *by its point of origin*. This last-mentioned factor must be borne in mind as the datum from which voltages are measured is of great importance in what follows.

Assume the point p in fig. 3 (a) is regarded as the datum, then the point q is regarded as having a potential of 100 V *above* that of p, which can be represented by the vector shown above the winding. Now consider again the same winding [fig. 3 (b)], but with the point r as the datum. If r is located in the middle of the winding the point q will have a potential of 50 V *above* that of r and the point p will be at a potential of 50 V *below* that of r. With respect to the point r, p and q are at opposite potentials, and the vectors will be as shown over this winding. The change in vector representation is due to the change in datum, or point of origin.



Figs. 3 and 4

Exactly the same considerations apply to the winding rt; with respect to the point of origin r, the point t is at a positive potential of 100 V, and if the point s be located 86.6 per cent. of the total turns measured from r, then s possesses a positive potential of 86.6 V with reference to r [fig. 4 (a)]. Now consider the point O, which is located 28.9 per cent. up the winding from the point r. With reference to this new datum, or point of origin, the point s is at a positive potential of 57.7 V, while the point r is at a 28.9 V negative.

As r in fig. 1 is a potential point common to both windings, the vectors of figs. 3 (b) and 4 (b) can be combined as shown in fig. 5, thus deriving the potentials of p and q with respect to a point of origin O. The potential of the point p is evidently equal to $\sqrt{50^2+28.9^2}$ (or 57.7 V), and the potential of the point q has the same value. Now, the angle α = arc cos 50/57.7 = 30 deg.; thus the vectors Os, Op and Oq are displaced by 120 deg., so that they represent the star voltages of a true three-phase system having 100 V between lines.

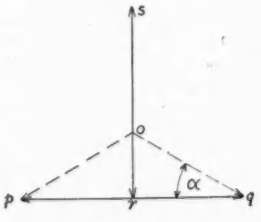


Fig. 5

Turning now to the question of current distribution, fig. 6 shows fig. 1 redrawn and connected to a load consisting of three star-connected non-inductive resistances. Suppose the current in both the primary phases connected to the two-phase source of e.m.f. is 100 A. Since the secondary ampere-turns must equate to the primary load ampere-turns, the current in the secondary winding rs must be 115.5 A, because the turns in RS are 100 per cent. and the turns in rs 86.6 per cent. By the same reasoning the resultant current in pq must be 100 A.

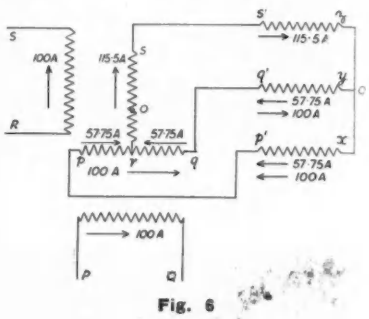
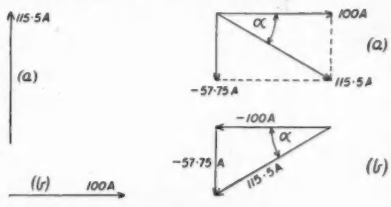


Fig. 6

No alternative distribution is possible. If, for instance, the midpoint tapping r in pq is accurately selected, then the 115.5-A load in s'z must divide equally between the paths q'y and p'x, since only under this condition will the ampere-turns due to this current in the winding pr exactly balance the corresponding ampere-turns in the winding qr. The currents above referred to produce zero flux in the core, and thus the windings pr and qr provide paths of low impedance for these currents. For similar reasons, no part of the 100-A load can be diverted into the path rs.

Referring to the load resistances, currents flowing from left to right are reckoned positive, and from right to left negative. If these currents were in phase with each other they could be added algebraically, and the current in s'z would be 115.5 A, that in q'y (100−57.75) being 42.25 A and that in p'x −157.75 A. But the currents of 100 A and of 115.5 A are in quadrature with each other, as shown in fig. 7, and they must therefore be added vectorially, in addition to taking into account the proper algebraic sign.



Figs. 7 and 8

Taking first the load resistance s'z, the current is evidently a positive one of 115.5 A, and is represented in fig. 7 (a). In q'y the resultant current is obtained by compounding the positive current of 100 A with the negative current of 57.75 A. This operation has been carried out in fig. 8 (a). Finally, the resultant current in p'x is evidently obtained by compounding the negative currents of 100 A and 57.75 A. The resultant current is shown as 115.5 A in fig. 8 (b).

By Kirchoff's first law, the algebraic sum of these currents must be zero at the point O' (fig. 6), and they are accordingly represented together in the vector diagram of fig. 9. Since the angle α in the diagrams of fig. 8 is 30 deg., the three currents are 120 deg. apart. Because the point s' is connected to s, the point q' to q, and the point p' to p, the currents in the transformer secondary windings must be the same as the currents in the corresponding load resistances; thus it has been shown that the system is a true three-phase one.

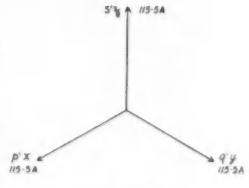


Fig. 9

Fig. 6 indicates that the 57.75 A produces no flux in the core when the whole of the winding pq is considered, and therefore the ampere-turn requirements of both transformers are satisfied. Another way of arriving at the same result is obtained by considering the resultant ampere-turns in the winding pq; this quantity is obtained by vectorially adding the ampere-turns in pr and qr, *i.e.* (115.5x50xcos 30 deg. x2) = 10,000, which equals the value of the primary load ampere-turns.

The power in the secondary windings equals

$$\frac{\sqrt{3}VI\cos\phi}{1{,}000} = \frac{\sqrt{3}\times100\times115.5}{1{,}000} = 20 \text{ kW}.$$

Since the losses have not been considered, this must be the power in the primary windings, or

$$2VI\cos\phi = \frac{2\times100\times100}{1{,}000} = 20 \text{ kW}.$$

Rural Electrification. By Nina Dyson Rayner

Making the most of the facilities available

AS the earning power of rural electrification is limited, it behoves all country dwellers to do their utmost to ensure the success of schemes devised for their benefit. An electricity supply undertaking only turns its capital over once every six years. Therefore it is necessary to make sure that extensions to its lines will be remunerative. Farmers are asked to guarantee a minimum revenue or to use a certain amount of electricity each year, and it has been found that the guaranteed amounts are usually well below the figure which it pays a modern farmer to expend on electrical energy.

A farm in Cheshire half a mile distant from the nearest electric lines may be expected to use £40 worth of electricity per annum; thus, at 1¼d. per kWh, 6,400 kWh is placed at the farmer's disposal. Electricity is offered to tenants of dwelling-houses in rural areas in Cheshire on a two-part tariff, a fixed charge of 20 per cent. per annum of the rateable value of the premises, plus 1½d. per kWh, or a flat rate of 6d. or 6½d. per kWh for lighting, 1½d. per kWh for cooking and heating, and 2½d. to 1½d. for power.

If the first method of charging is chosen the minimum amount will usually be in excess of the cost of the quantity of electricity used by consumers for lighting only. Therefore, rather than pay for energy not consumed, electrical appliances are purchased to enable the full benefit to be derived.

Isolated farms and estates must necessarily view the capital expenditure on service lines in the same light as a firm invests part of its resources in private plant. The farmer is absolved from all worry of generating, plant upkeep, &c., and has a reserve of energy always available for extra work either on the farm or in the home.

Scope for Development

There are approximately 400,000 agricultural holdings in England and Wales, and between 6,000 and 7,000 farms have now been connected to the public supply. There are probably several times this number which could be connected but have not taken advantage of the facilities offered.

The Chester Corporation supplies electricity over an area of 143 square miles in which there are 1,574 agricultural holdings, nearly 30 per cent. of which are connected to the supply and consume annually approximately 1,354,000 kWh of electricity. Milk and cheese production and the rearing of pigs are firmly established, while poultry farming is rapidly extending.

The Electrical Farm

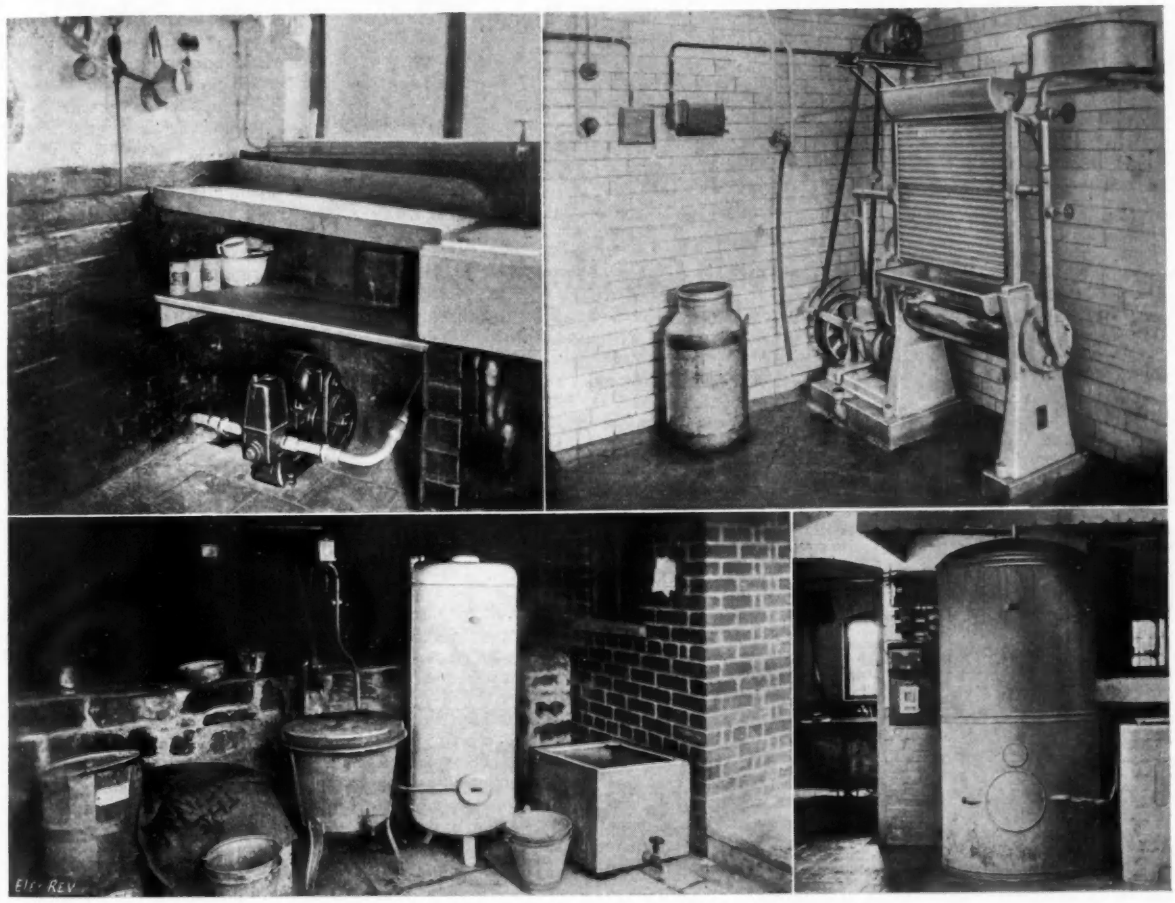
Work on the electrical farm commences with the switching on of the light and plugging in of the electric kettle. Separate switches control the cooker, electric radiator and water heater. A large quantity of hot water is required for the cheese vat and other dairy operations, and the heating takes place during the night.

All outbuildings and yards are illuminated by pressing a switch, and the electrically driven motor pump commences to provide for the day's supply of water when once set in motion. Liquid pig food, previously pumped into a storage tank, is distributed by means of the mere opening of a valve. The milking of cows is performed expeditiously by electrical plant, and the cold storage refrigerator and milk cooler operate continuously or intermittently as the occasion demands.

In the barns machinery for cutting chaff, corn, roots and other foodstuffs is available whenever required. The laundry is equipped with an electric wash-boiler, washing and ironing machine and electric irons. A portable motor is attached to the elevator to lift the crop into the barn or stack at the harvesting season; and when threshing is done an electric motor performs the task with ease, and the produce is more uniformly graded.

Radiant heat and good lighting in farrowing and lambing sheds for the first ten days reduce mortality, and each animal saved by these means is of definite monetary value, the gain far exceeding the cost of the electricity consumed.

The outputs which may be obtained from each kWh of electricity include: butter-working, 160 lb.; cheese-curd grinding, 6 cwt.; churning, 120 lb.; cooling, 30 gallons; milking,



Some Applications of Electricity on a Farm

1. The electrically driven pump which provides the water supply. 2. Milk cooling plant. 3. Water heater and boiler for preparing pig food. 4. A 200-gal. heater for dairy work

22 cows; pumping, 650 gallons; separating, 150 gallons; and bottle-washing, 1,000 bottles.

For heavier farm work the outputs and sizes of motor used are: chaff-cutting, 6 cwt. (3½ to 5 h.p.); cake-breaking, 22 cwt. (1½ to 2 h.p.); crushing, 6-8 bushels (3 to 7 h.p.); elevating hay, 2 tons (2 h.p.); grinding corn, 3 bushels (3 to 7 h.p.); kibbling, 8 tons (3 to 7 h.p.); root-cutting and pulping, 2 tons (1½ to 3 h.p.); threshing, 4 bushels (12½ to 20 h.p.); clipping, 12 horses (½ h.p.); shearing, 20 sheep (½ h.p.); and grooming, 40 horses and 60 cows (½ h.p.).

Thus it will be seen that the average costs are very low, and in many districts where the charge per kWh is only 1d. pulping and hay-elevating cost ½d. per ton, corn-grinding 2½d. per cwt., pumping 1d. for over 600 gal., and threshing 9d. per ton. Wood-sawing costs approximately 3d. per hour, and a huge amount of fallen timber, old fence rails and posts may be cut up in this period.

Water Supply

To all farmers and rural dwellers an adequate water supply is necessary. A national water grid has been suggested, but has not been found practicable owing to the dwellings being so far apart. It would be extremely costly to interconnect the high-pressure mains which carry water to distributing centres only, and hydraulic plant with reservoirs would be necessary. The electric mains which are now available can, and do, supply the power to obtain local supplies of water from wells and springs. In addition to supplying water for the farmhouse, yards and outbuildings, it is also sent through pipes to replenish the various drinking-troughs in the grazing fields.

For small groups of cottages the automatic-pressure system (water stored under pressure in a tank) works out cheaper than individual tanks and pumps fitted in each cottage. Pumps capable of delivering 300 gal. per hour are reliable and inexpensive, and may be either of the piston type (both single cylinder and double-acting, low and high speeds) or centrifugal pumps which can run at a very high speed. It is often quite an easy matter to convert existing pumps into electric ones by means of a belt-drive from a motor.

For the disposal of farm sewage, motor pumps may be used to empty septic tanks, the correct level being maintained by means of a float switch, and the liquid pumped over farm land and gardens.

Rural Factories

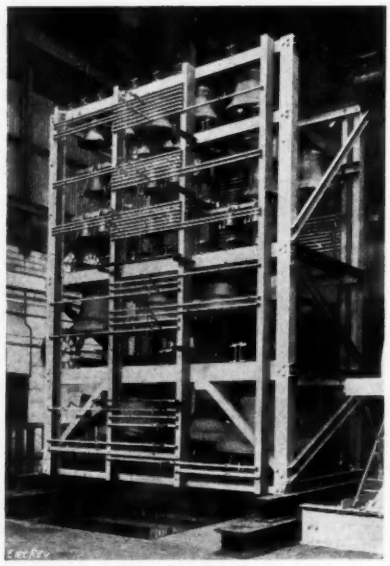
Manufacturers are now building their factories in the country, and by means of the facilities which the grid offers they are able to equip them with every electrical appliance necessary. Until recently it was desirable to build factories near to railway lines; also, transport difficulties compelled manufacturers to establish their businesses within reasonable distances of the coalfields. Electric power has now made it possible for most trades to be carried on in the country, and without smoke, too, and excellent roads from villages to the towns have helped to make road transport easier.

I am indebted to Mr. S. E. Britton, M.I.E.E., M.I.Mech.E., for assistance with this article and for the photographs.

An Electrical Carillon. By T. R. Robinson

THE carillon now installed at St. John's Church, Perth, Scotland, consists of thirty-five bells, all except the bourdon being suspended in a specially constructed steel frame provided with both hand and electrical playing attachments.

Each bell has a clapper connected by crankwork and suitable draw-wires to the plunger of a pneumatic piston. An electrically driven compressor feeds air to a receiver, and its admission to the piston cylinders is controlled by electro-magnetic valves. The circuits of these valves are in turn controlled by a player-machine, the principle of which closely resembles a pianola, except that the perforations in the music band allow fingers to complete the circuits and thus operate the control valves of the pneumatic pistons. Simple but ingenious interlocking devices control the various stages of the action.



The new bells suspended in a steel frame

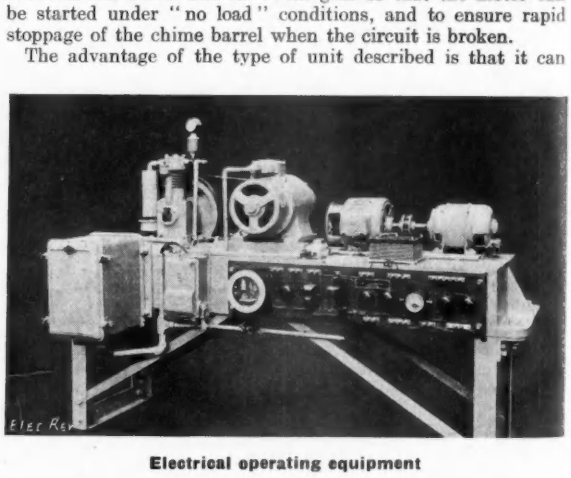
The operation is originated by the tower clock, which closes a local circuit and trips the small relay switch actuating the contactor switch. This starts both the motor driving the air-compressor and the small motor-generator set delivering the 25-V d.c. used for the contacts on the player and the operation of the piston valves. The circuit of the player machine motor includes the pair of contacts below which is a weighted piston in a cylinder connected to the compressed air supply. Only when the pressure in the air receiver is sufficient to operate the pistons of the clappers can this small piston rise and close the player motor circuit.

To the heavy frame is hinged a swinging arm carrying the fractional horse-power motor used to drive the music band drum, the drum itself, and the contact roller by which the circuits of the electro-pneumatic valves are closed. In front on a second arm are mounted the contact fingers associated with the valve circuits. These are so positioned that they normally touch the metal contact roller on the main arm, but are usually insulated from it by the paper of the music band.

The small motor drives the music band roller through a rubber belt and subsequent speed reduction is obtained by a worm gear. For adjustments and changing the music bands the arm carrying the contacts is first swung on its pivot, and the outward movement of the main arm then permits of easy access. In conjunction with the driving pulleys a small sliding rheostat permits the music band speed to be adjusted.

The contact fingers and valves of the pistons are connected by telephone cable with quickly detachable terminals to permit of rapid tests. The hand operation of the carillon is from a clavier, for which a second clapper is provided for each bell, and the two systems are thus quite separate. The chimes of the clock are also sounded on the carillon, and for this purpose certain bells are fitted with a third hammer, and a small motor drives the chiming cam barrel through an enclosed worm gear and two stages of spur gears. Short duration contacts are made by the timepiece portion of the turret clock at each quarter hour, and these operate a mercury tube relay switch on the chiming unit, thus closing the driving motor circuit. At the conclusion of the chiming the motor is tripped by pins on a controlling count-wheel. A centrifugal clutch is fitted between the motor and its worm gear so that the motor can be started under "no load" conditions, and to ensure rapid stoppage of the chime barrel when the circuit is broken.

The advantage of the type of unit described is that it can



Electrical operating equipment

be located close beside the bells on which it is to chime, and the long lengths of draw-wires and multiplicity of cranks and levers can be entirely dispensed with. The chiming unit is provided with interchangeable barrels and the carillon tunes are changed by simply shifting a paper band.

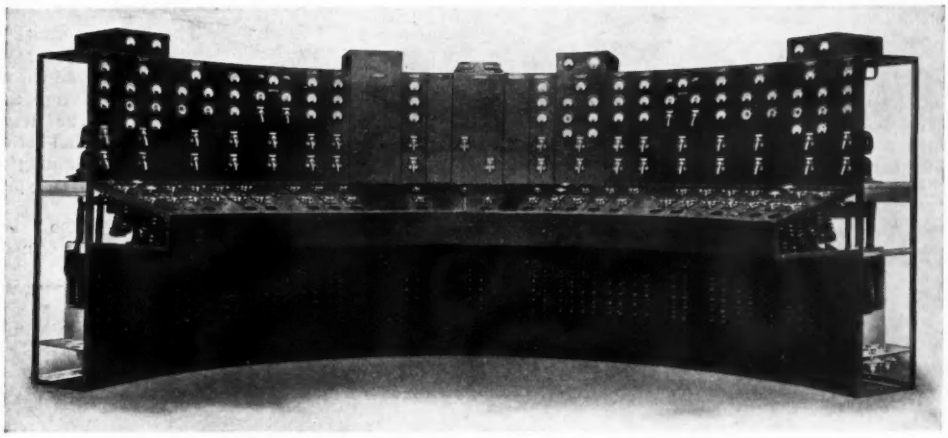
All the equipment for the installation, including thirty-four new bells (the old bourdon, cast in 1504, is retained) was supplied by Messrs. Gillett & Johnston, Ltd.

Miniature Instruments.

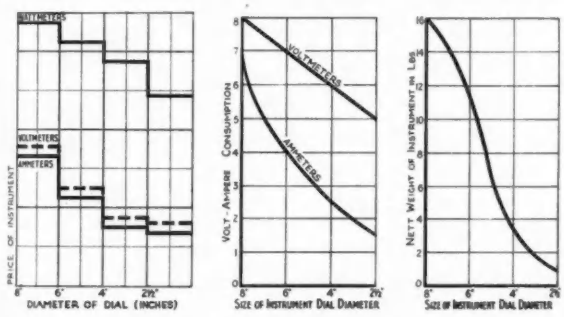
By C. L. Lipman, A.M.I.E.E.

A NEW series of miniature measuring instruments with long circular scales has recently been developed which makes it possible not only to reduce switchboard panel space but also to bring about economy in many other ways. The accuracy of modern induction type instruments for industrial purposes has risen to first grade level, according to British Standard Specifications, and to sub-standard grade for special testing requirements.

The miniature instruments are manufactured with 2½ and 4 in. diameter dials, and they embody all the improvements and good features of the former 8 and 6 in. dial instruments. They can be supplied mounted in either projecting or flush pattern round cases. Included in the series are ammeters, voltmeters, wattmeters and varmeters (reactive kVA meters), all giving 300 deg. angular deflections. The uniformity and boldness of the scale divisions of a 2½-in. diameter dial projecting pattern induction wattmeter is shown by the accompanying actual size illustration. For such an instrument the length of scale is 5 in. and for a 4-in. diameter dial instrument it is 8 in. The wattmeters are available for single and polyphase unbalanced load circuits.



Miniature-type remote control board in course of assembly



Prices of switchboard instruments (left), power consumption of windings (centre), and weight of complete instrument

The miniature-type remote-control switchboard illustrated is for the electrical operation of a 22-unit 33-kV duplicate-busbar metalclad switchboard, rupturing capacity 750,000 kVA, and was manufactured by the English Electric Co., Ltd.

The indicating instruments are of the flush-mounting pattern

An induction wattmeter, actual size

with 2½-in. dials, the scales being very clearly marked so that they can be read with ease at a distance of several feet from the board. The approximate overall dimensions of the board are: height, 5 ft. 6 in.; depth, 3 ft. 3 in.; and developed length along the front, 11 ft.

Space saving effected by the miniature-type board is evident on comparison with the equivalent conventional cubicle type board employing 8-in. dial instruments, the approximate overall dimensions of which would be: height, 10 ft. 4 in.; depth, 2 ft.; and developed length along the front, 60 ft. From this it is possible to comprehend the extent to which the switchboard costs are lowered through space economy with the long-scale induction-type miniature instruments. The relative prices of standard sizes of instruments can be judged from the accompanying graph dealing with this aspect.

No less striking are the technical advantages of the new instruments. Reference to the appropriate graph will show that the voltampere consumption of an ammeter winding for a given current range falls from 7 VA for an 8-in. dial instrument to less than 1½ VA for a 2½-in. ammeter. Similarly, the voltampere consumption of voltmeter windings falls in the ratio from 8 to 5 for a given voltage range of the instrument.

Portable a.c. testing set

This feature enables instrument transformers of smaller output to be employed, thereby effecting further savings in the capital outlay. Moreover, the miniature ammeters can be wound for 1 or 0.5 A full load secondary current and are thus suitable for working off bushing type current transformers having low primary ampere-turns and limited output.

Miniature induction instruments are of particular advantage for export trade, for whereas an 8-in. dial induction ammeter weighs 16 lb. the weight of a 4-in. dial model is only 3 lb., and the weight of a 2½-in. dial ammeter is 1 lb.

Another important application of the principle is the portable circuit analyser (illus.). This set is designed for rapid a.c. testing and comprises four 2½-in. dial long-scale instruments, namely, an ammeter, wattmeter, voltmeter and power-factor meter. The portable set can be arranged for either single-phase or polyphase circuits. It is entirely self-contained and inter-connected for any combination, thus avoiding the multiplicity of external connections.

The overall dimensions of the four instrument combination are 11 in. by 7½ in. by 3 in., and the total weight is under 7 lb.

The author is indebted to Messrs. Nalder Bros. & Thompson, Ltd., for permission to publish the above information.

The Ideal Home Exhibition

Electricity well represented

THERE is a definite jubilee atmosphere about the nineteenth Ideal Home Exhibition which is being held at Olympia from March 26th to April 18th. Nearly 500 exhibitors present an imposing array of things useful and beautiful for furnishing and equipping the home.

The decorative feature this year is a striking series of mural paintings in colours round the main hall, which are floodlighted at night. On the 1,000 ft. of canvas 36 ft. in height are depicted outstanding events of the last twenty-five years, including scientific, electrical and engineering achievements, together with several hundred international celebrities.

In the model village of nine houses is a replica of the "King's House," the jubilee gift of the Royal Warrant Holders' Association, has some electric fireplaces and clocks. Apart from illumination, the place of electricity in these model houses has evidently been given much more consideration this year than has been the case in the past. For instance, in the Davis "Suntrap" house a special telephone fitting is provided in the hall and both reception rooms have coal fireplaces with supplementary electric panels in the tiled surrounds. In the kitchen is a special point for ironing and a built-in cupboard to accommodate the refrigerator. The principal bedrooms have coal-electric fires with tiled surrounds, the smaller rooms being fitted with electric wall panels. All electric fires are standard equipment and can be operated from the bedside, and a portable fire is included in the very modest price.

Two of the bedrooms of the Crouch house have panel electric fires, while the Wates chalet has plug points for power, wireless, reading lamps, and bed lights, all the wiring, switches, and fittings down to lampholders being included in the price. The Laing house has plugs and switches in all rooms, and in the Morrell house the stainless steel kitchen sink incorporates a special unit to contain a refrigerator.

The Berg "Tri-plan" is fitted with electric power and wireless points in every room and there is an immersion heater in the water tank for use in summer when the boiler is not required. The "Coalelectric" bungalow has a coal fire in the lounge, but otherwise is equipped for the use of electricity.

The Electrical Exhibits

Indeed, electrical equipment is much more evident throughout the exhibition as a whole this year. In the foodstuffs section electric cookers and refrigerators are to be seen on several non-electrical exhibitors' stands, and one breadmaker has a large electric oven. In the "University of Cookery" adjoining a lecture theatre there is a series of model kitchens, including, for the first time, an all-electric example furnished with G.E.C. equipment, and another designed entirely for "cold cookery" with the aid of Electrolux refrigerating devices.

At the foot of the main staircase leading up from the main hall to the gallery is the stand of the British Electrical Development Association. Grouped conveniently round it are a number of stands of the fifty-five electrical manufacturers taking part in the show, to whom further reference will be made next week. Cooking, heating, vacuum cleaning and lighting seem to predominate, apart from the extensive grouped displays of a dozen different refrigerator makers.

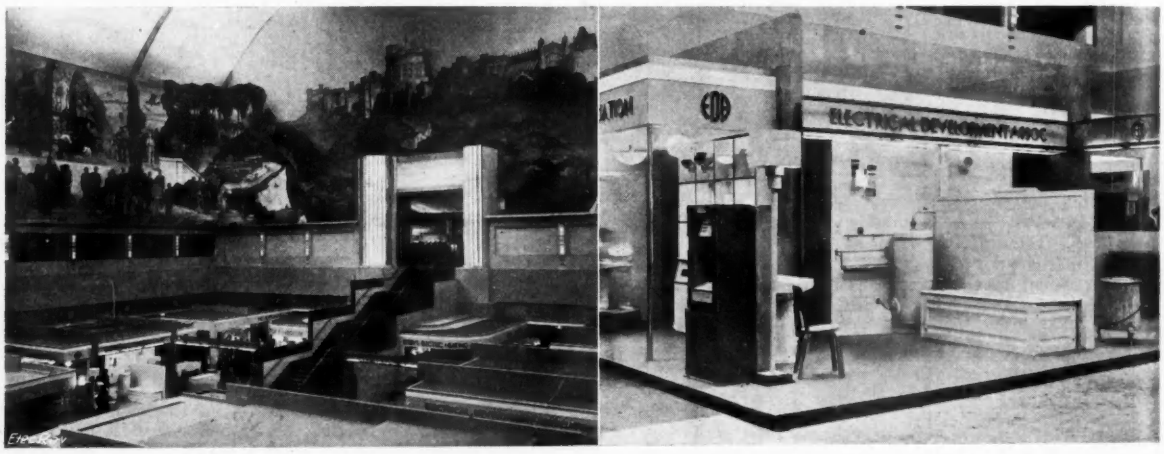
A selection of machinery in operation, mostly made by Mather & Platt, Ltd., and driven by electric motors, illustrates the new British industry of fruit canning.

The Development of Radio

The King Edward Hospital exhibits include a section devoted to electro-medical appliances, while two large groups of technical equipment illustrating progress in the G.P.O. are displayed for inspection. The development of the gramophone from the early external-horn pattern to the modern H.M.V. auto-radiogram containing fifteen valves and more than 6,000 component parts is typified by the Gramophone Co., Ltd.

"Twenty-five Years of Radio" is portrayed by the Marconiphone Co., Ltd., which has combed the country for historic apparatus, including some of the early experimental equipment used by the Marchese Marconi and the first radio-telephone transmitter ever used, which employed a Poulsen arc as an integral part of its mechanism.

In addition to equipping the "Free Cinema" with sound film-reproducing equipment, the Western Electric Company has also specially designed stage amplification and announcing systems for the Theatres of Fashion and Cookery. A feature of these installations is the employment of a miniature microphone the size of a half-crown and weighing 1½ oz. which is clipped to the speaker's lapel, giving him freedom to move to any position on the stage without affecting the efficient pick-up qualities of the instrument, since it retains close relationship to the source of sound, while the size of the instrument makes for greater ease of concealment.



A view over the Electrical Section showing the pictorial panels which are floodlighted at night and the illuminated entrance to the gallery, and (right) a section of the E.D.A. display

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Breach of Factory Regulations

FOLLOWING the recent death from electric shock of James George Kitsell, Messrs. Churchill Johnson, Ltd., builders' merchants, were summoned last week at Billericay under the Factory and Workshops Act for "failing to take precautions by earthing or other means to prevent metal other than a conductor from becoming electrically charged." James A. Anderson, the contractor employed by the company to carry out certain electrical work, was also summoned on a similar charge.

Prosecuting on behalf of the Home Office, Mr. A. G. Lowe, Inspector of Factories, said that on January 17th Manning, a timber porter, while loading a lorry at Messrs. Churchill Johnson's wharf at Vange hit an electric lamp standard with the load on his shoulder, causing a watchman's key to fall from a box on the standard. This box also contained a lighting switch. Manning went to put the key back which was dangling on a chain but receiving a shock left it. Soon after he found Kitsell dead, holding the key. On examination Home Office inspectors found that a screw had inadvertently been put in a wrong hole, thus causing the apparatus to become alive. If the apparatus had been earthed this would not have mattered.

With regard to work undertaken by Anderson it was stated that the installation of the standards had been carried out previously and that he was asked to repair all defects necessary. He was aware that the standards were not earthed.

The Bench dismissed the case against Anderson but fined Messrs. Churchill Johnson £50 with £1 16s. 6d. costs.

A Modern Meter Factory

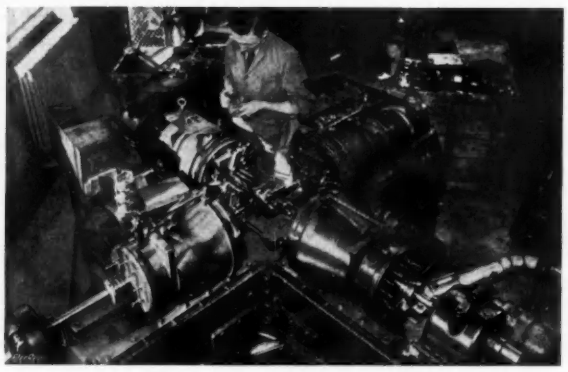
AMONG the more important developments of house-service meter design and construction two of the most far-reaching are probably the introduction of all-insulated housings and prepayment models made to accept coins of three denominations through a single slot.

About two and a half years ago the British Sangamo Co., Ltd., produced the "Type H.M." single-phase watt-hour meter with a moulded bakelite case and base. A little later this method of housing was applied to prepayment models also, and to-day almost all the output of meters from the company's Enfield works is of this type.

Not only does bakelite enclosure provide complete insulation and therefore safety without the necessity for earthing, but it is also extremely light and unexpectedly strong. Moreover, since the material is not liable to corrode, it affords better protection to the meter element than metal and at the same time eliminates the maintenance charge of painting.

An important fact regarding the three-coin prepayment meter is that its installation in place of the single-coin pattern has been proved to result in an appreciable direct increase of revenue because of the convenience to the consumer of putting shillings, sixpences, and pennies in one slot.

The Sangamo three-coin single-slot prepayment meter has been on the market for over two years and is claimed to be still the only one of its class available. Its utility is considerably extended by the addition of a fixed-charge collector device.

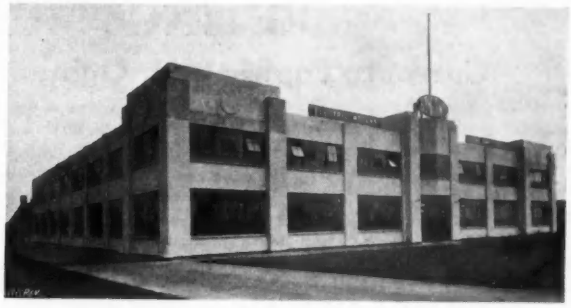


A multi-spindle, four-direction drilling machine

Features of the factory processing are the precision machine tools employed for cutting the gear trains, the magnetic conditioning, and the repeated inspection and check examination of the essential component parts, while the company makes all its own bakelite mouldings for meter housings.

Microscopic examination is made of lower and upper bearings under special high candle power mercury lamps, which are also installed in the train assembly departments. Special inspection is made of rotor shafts, while the projector method is used to ensure the correct form of the teeth of gear wheels at a magnification of 300. Series coils are treated for insulation by impregnation four times, each of the first three coats being baked on for four hours, the final operation consisting of dipping cold and baking for six hours.

All iron castings are ground and gauged and passed through the heavy machine shop where there is a large selection of multiple Boley drilling and tapping machines, drilling presses, milling and profiling machines. Of special interest are the four-direction horizontal multi-spindle drilling machines, the heads of which move towards the centre simultaneously in four planes and which are capable of drilling and tapping forty-eight different holes in one operation in these planes.



In the light machine department worm shafts, pinions and gears are hobbed on "Mikron" machines. Special three-bearing lathes, the heads of which are fitted with air chucks, are used for the individual setting of jewels and guides in the bearing screws, and for the spinning in of the upper bearing in the rotor shafts. The smaller components are manufactured in the punch press department, and the processes here include the assembly of the stators of synchronous motors, operations on train plates and brackets, magnetic mounting rings, plates, light load vanes and the blanking and stippling of rotors.

For the manufacture of all tools the tool room, to ensure precision jobs, includes a jib borer capable of machining to an accuracy of one-tenth of one thousandth of an inch in terms of rectangular co-ordinates. Beyond the special department for the assembly of current transformers, the assembling, testing and time running of time switches, synchronous motors, and clock movements is carried out. All the boring and staking for staff and wheel assemblies is done on Boley lathes in the detail assembly department, where the various sub-assemblies and final assembly of the prepayment attachment, the fixed-charge collector and trains are made. Of particular interest is the fact that during test fifty coins of each denomination are inserted in each of the multi-coin prepayment attachments.

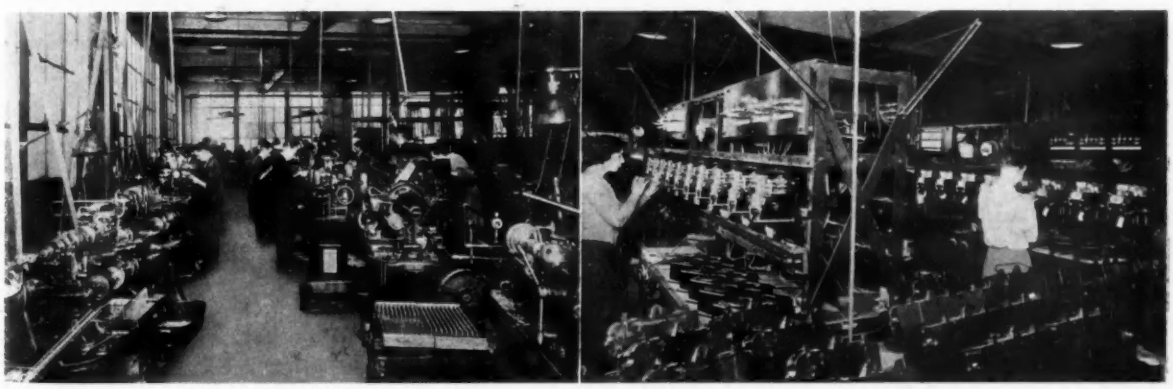
Permanent Magnet Testing

After stroboscopic testing and ageing of the permanent magnets the meters are finally tested by master meters which are all checked every day by watt meters and stop watches. As an additional check on the master meter and operator, special operators test batches of meters taken at random from all meters passed in this department. After a flash test at 2,000 V for two minutes they are ready for shipment or stock.

Among the various products seen last week in the course of manufacture was the "Type H.M." single-phase meter. Its design is simple, having the advantages of accessibility and interchangeability of parts. The bearing system is held by one grid which is dowelled and screwed to the main grid holding the magnetic system by three screws only, and thus the meter can be very easily assembled or dismantled. Prepayment meters are manufactured to take one, two, or three coins in one slot.

A further development is that fixed charge collectors can be fitted to all large base prepayment meters and are available to collect from ¼d. to 1s. 10½d., 1d. to 3s. 9d., and 2d. to 7s. 6d. per week. The collector embodies the Sangamo low-speed synchronous motor; its operation is simple and the rate of collection can be easily varied without removal of the meter cover.

Other products include portable test meters, test benches, test blocks, polyphase meters, maximum demand attachments, instrument transformers, ampere-hour meters, synchronous motors, and time switches.



Left: The automatic machine department. Right: A section of the test department

MEETINGS AND DISCUSSIONS

Current Topics and Opinions Expressed at the Institutions

Power-factor Correction and Tariffs

POWER-FACTOR correction was one of the few important economies remaining to be achieved by the electricity supply industry, said Mr. E. W. Dorey in a recent lecture delivered to the ASSOCIATION OF SUPERVISING ELECTRICAL ENGINEERS in London, when he ventured to suggest that the day was not far distant when all a.c. supply undertakings would introduce a p.f. tariff in some form.

Distribution mains had to carry the energy current plus the idle wattless current (which lagged 90 deg. behind the voltage) required to excite motors and transformers, &c., and was the direct cause of low p.f. A portion of the capital expended on distribution was therefore unproductive so far as revenue from the sale of energy was concerned. Idle current meant idle capital, which had to be paid for by the consumer, since he was responsible for low p.f.

Was the loss involved fully realised? During the year 1929-30 1,313,102,170 kWh was unaccounted for, representing 12.3 per cent. of the energy generated. In 1930-31 the percentage was 12.7. At an average price of 1.2d. per kWh sold, 12 per cent. of 600 million kWh per annum represented a loss of 0.144d. per kWh, which was about the same as the fuel cost (0.15d. per kWh). Thus any measure of p.f. improvement would release idle capital locked up in mains and reduce the all-in cost.

Power-factor tariffs were very varied, but could be divided into (*a*) any standard tariff with a p.f. bonus/penalty, which involved a type of metering not understandable by the average consumer, and (*b*) a two-part tariff incorporating a fixed charge per kVA of maximum demand, plus a running charge per kWh consumed. The great advantage of (*b*) was that it made no direct reference to the term "power factor," and a reliable and easily understood type of measuring instrument could be employed. A fixed charge varying from £2 10s. to £8 per kVA per year was readily acceptable to the average consumer, but one or two applications of this form of tariff left much to be desired. It might pay, in certain circumstances, to couple up reactance in the form of, say, an idle transformer in order artificially to raise the kVA demand and thus earn a higher rebate, which the author contended could not be justified.

Another tariff, unique and recently introduced, took the form of metering the reactive and so-called sine kWh separately and charging for them at the rate of one true kWh for every eight sine kWh. A sine meter was as accurate as a cosine meter. At 75 per cent. p.f. 882 sine kWh would be recorded per 1,000 true kWh. One-eighth of 882 equalled about 110, so that if the p.f. were raised to unity the charge would be for 1,000 instead of 1,110 kWh, a reduction of 10 per cent. One grave objection to such a tariff was that it encouraged the consumer to correct his p.f. right up to unity, whereas 95 to 98 per cent. lagging was generally considered to be the commercial limit.

Some of the instruments and methods of metering for p.f. tariffs referred to in the lecture were described as expensive, and others as complicated. Examples were given of how p.f. should and should not be corrected, with calculations of the condenser capacities required therefor, and brief reference was made to p.f. correcting plant.

The Telephone "Load"

POWER plant for automatic telephone exchanges is the subject of the paper by Mr. K. B. Baldwin that was read before the London Students' Section of the INSTITUTION OF ELECTRICAL ENGINEERS on March 22nd. The consumption of electrical energy in Post Office telephone exchanges in the United Kingdom and Northern Ireland has been estimated now to be in excess of 20 million kWh per annum. The telephone engineer has to deal with all classes of power plant ranging from that of the small 8- or 10-line rural exchange to those with a current consumption of approximately 20,000 Ah per day. The capital cost of the entire power plant of an exchange now approximates to 10 per cent. of the total cost of the telephone exchange equipment, and for a large exchange may amount to as much as £10,000.

The function of the power plant is to furnish electrical energy at the appropriate voltages for (*a*) energisation of operators' and subscribers' transmitters; (*b*) subscribers' and exchange signalling; (*c*) provision of tones, &c.; (*d*) operation of switching mechanisms (there may be approximately 16,000 switches and 65,000 relays in a fully equipped 10,000-line exchange); (*e*) sundry purposes, *e.g.*, alarms and emergency lighting.

The usual source of supply is the local generating station; continuity of supply is of paramount importance and hence alternative sources of main supply, such as secondary batteries, and prime movers, are essential. In this country large exchanges are worked almost entirely on a charge-discharge basis, although assisted-discharge is now being adopted; floating systems are extensively used in America.

The conversion of the energy derived from supply mains to the appropriate d.c. voltage is generally accomplished by means of motor-generators. When the machine is floated on the battery an electrically quiet machine is essential, and mechanical quietness is desirable in order to avoid acoustic interference; when the "charge-discharge" method is adopted, commercial-type generators are usually employed. Automatic voltage regulation is employed in conjunction with float systems.

Some of the largest storage batteries in use are employed for telephone exchanges, and a fully equipped 13,000-Ah cell weighs over three tons. Lead-lined wood containers are used on account of the difficulty experienced in forming glass to the required size. Autogenous lead burnt connections appear to be preferable because of their more uniform ohmic resistance. It is important to ensure that the plates do not stand long immersed in the acid before the initial charge. About 5,000 gallons of acid is required for a battery of 50 cells; by using a 300-gallon tank wagon, which may be emptied in about twenty minutes, it is possible to fill fifty cells in six hours. Room ventilation is of importance on account of the emisssion of gas which occurs during charging. Several methods for overcoming the disadvantages which accompany this gassing have been tried, but so far with little success.

The power system is protected by a system of graded fusing and it may usually be assumed that if the feeders allow an overall voltage-drop of not more than 1 V they will satisfactorily carry the maximum current.

In addition to the main power plant described, a telephone exchange includes auxiliary apparatus, such as booster batteries, rack lighting, &c. Ringing machines are primarily

Two Jubilee window displays. The left-hand one is included in the E.D.A. April programme; the other is one of the G.E.C.'s windows at Magnet House, Kingsway

used for furnishing ringing current, but perform subsidiary functions in the supply of tones. Each large exchange is provided with a ringer driven from the normal supply and another as a stand-by driven by the exchange battery. Tone induction generators are used for some exchanges abroad, instead of the high-speed drum machine. These devices eliminate the necessity for brush-gear, and both the exciting and stator windings are stationary. The tone inductor consists of several stators mounted in one case with a d.c. exciting system and a rotor with the requisite number of teeth to give the desired frequency. Special precautions are taken in the distribution of tone leads to prevent interference with talking circuits.

In addition, power supply is becoming increasingly important in connection with repeater stations, carrier telephony, teleprinters, telegraph stations, and radio telephony. The success of, and advantages derived from, automatic voltage regulation indicate that in the near future more extensive use of automatic operation of power plants as at present successfully applied in small exchanges is likely to be introduced. The extended use of better filter arrangements is likely to permit the more general use of ordinary commercial machines. The adoption of "float" schemes will probably become general, and a considerable reduction in cost of telephone power plant may be anticipated.

Rural Installation Protection

AT the informal meeting of the INSTITUTION OF ELECTRICAL ENGINEERS in London on March 18th Mr. H. Leyburn opened a discussion on the protection of consumers' installations in rural areas.

He said that he did not propose to discuss the comparative merits of the all-insulated or the all-protected types of installation. He was impressed with the difficulty—the impossibility even—of obtaining an earth contact in some rural situations. Alternative methods of earthing were by the water main (a service frequently not available in rural districts) and by the "solid earth" system. With either method there arose further considerations, such as insurance that the protective device would not disintegrate in service and the need for education and propaganda among consumers in order that no misapprehensions might arise and that the need for periodic inspections and tests might be appreciated.

It was also very desirable that some official or self-constituted authority should obtain the enactment and application of statutory regulations for the safety of electrical installations. Mr. Leyburn showed and explained a number of slides and graphs of resistance loss and protective arrangements, and proceeded to recommend a number of methods of safety devices and testing.

Some of the subsequent contributors to the discussion questioned the need for expensive protective devices. Mr. A. Morgan thought more and better insulation was the desirable solution. Mr. F. Jackson said that if we made our houses really all-electric there need not be any earthed metal to create danger. Mr. H. Bright advocated tough-rubber insulation with a continuous earth wire embedded in it as adequate protection for all small installations. Mr. K. M. Mackenzie remarked that to say "insulate is the remedy" was to forget that a best quality installation embodied protection against failure of the insulation.

Mr. J. F. Shipley said that so far as he knew only New Zealand, Malaya, and Nigeria, had statutory rules for the regular inspection, measurement, and logging of earth protection, but this compulsion applied only to the supply authority and not to the consumer. Mr. A. F. W. Richards said that many of the trip devices proposed worked on the wrong principle. Calculations of ohmic resistance were interesting, but the trouble resulted in most cases from reactance.

Earthing in Ireland

ON March 21st Mr. T. C. Gilbert carried his campaign for better "earth" protection over to Ireland where he spoke at the local centre of the INSTITUTION OF ELECTRICAL ENGINEERS to an audience which would have been bigger but for the tram and bus strike. The discussion raised no points which have not been mentioned already in the ELECTRICAL REVIEW either in Mr. Gilbert's articles or in the reports of meetings at other Centres.

The subject is of considerable interest in Ireland because of the hundreds of rural areas which are being served. The general feeling seemed to be that earth trips should be connected to all electrical farm appliances, but that in towns it might be undesirable to use them except in bathrooms and places where similar risks existed; unless, indeed, the trip became identical with the main switch. A particular note of warning was sounded against earthing a metal-framed radiator with exposed elements.

It was suggested that the general use of earthing trips might have the secondary effect of lowering the standard of wiring, but it was thought on the one hand that this was a very remote possibility, and on the other that it was an impossibility!

To the question as to what would happen should a trip coil burn out, Mr. Gilbert replied with complete justification that there would be then no protection, but that until such an unlikely failure occurred the trip really did protect, whereas everyone knew how uncertain the usual earthing system could be, and how seldom its efficacy was tested. The trip could be tested with no trouble at all, and routine testing could be done by the meter reader if the consumer had not enough intelligence to do it himself.

Mr. Gilbert made telling points by saying that the system had been compulsory in Germany for eight or nine years, and that the latest records of the London Fire Brigade showed that 77 per cent. of the proved electrically started fires occurred in lead-covered installations.

Power System Stability Reviewed

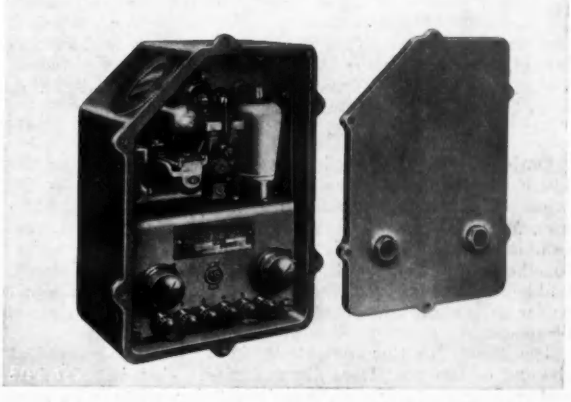
THE stability characteristics of alternators and of large interconnected systems are dealt with in the paper by Mr. W. D. Horsley, of C. A. Parsons & Co., Ltd., which was read before the INSTITUTION OF ELECTRICAL ENGINEERS in London on March 28th.

Instability is often caused by line faults and is therefore more likely to be experienced in systems having long overhead lines and in countries where lightning storms are frequent. The lightning problem, while requiring investigation, is not acute in Great Britain, but many forms of instability may occur in the operation of large systems. The majority of papers published on this subject have dealt with one aspect only, or have failed to differentiate between essential conditions of operation, so that confusion has arisen.

The author has therefore endeavoured to review the various types of instability, and to present the characteristics of alternators which affect stability on a fundamental basis, in order to facilitate the interpretation of some of the more obscure phenomena that have been experienced.

The more important factors determining the power limit and transient stability are reactance, speed of operation of protective apparatus and switchgear, and automatic voltage regulation. Damping windings play an important part and, in general, assist in reducing the effects of disturbances to the system. The short-circuit ratio of alternators is of less importance provided that suitable automatic voltage regulation is employed in conjunction with a suitable rate of response of the excitation. An improvement in speed regulation would assist in increasing electrical stability, but up to the present the difficulty of avoiding instability of sensitive governors has impeded progress in this direction. It is probable that in the near future the advantage of closer governor regulation will be obtained. The development of automatic frequency control may also be beneficial.

Mr. Horsley shows that automatic voltage regulation is of considerable importance in increasing the load limit and stability of an alternator. Its adoption frees the load on the system from all limitations except that imposed by the characteristics of the transmission line.



Shown by the B.T.H. Co. at the Institute of Physics Exhibition, Manchester: A photo-electric relay designed as an outdoor weatherproof unit for controlling artificial light according to daylight intensity

Better Times

The B.E.A.M.A. Council's report and forecast

THE report of the Council of the British Electrical and Allied Manufacturers' Association for the year ended September 30th, 1934, says that last year's forecast of improved conditions has been justified, and all indications for the present year point to continued improvement. Nevertheless, there are a few factors in the general situation which still give cause for anxiety, for the problem of the balance of world economy is still unsolved.

Within the Empire, however, some recovery has taken place due to very special causes. As a consequence of the formation of the sterling bloc, the Empire overseas has taken a considerably higher proportion of electrical products compared with recent years. By far the greatest proportion of our electrical machinery exports were consigned to the Union of South Africa.

The reappearance of the Central Electricity Board in the market for electrical machinery was a welcome manifestation of confidence in the continuance of the public demand for electricity, reinforced, as it was, by some recovery in the industrial power load.

In the various branches of heavy electrical manufacture, business was again uneven, but a pronounced upward swing was apparent on the whole. Prices were, however, such that, in too many cases, profit margins were and are still reflections of slump conditions.

Advance in Small Apparatus

Producers of smaller apparatus continue to fare satisfactorily, but the 25 per cent. increase in imports compared with 1933 demonstrates the inadequacy of the present duty on such lines as accessories, meters, instruments, and carbons. The domestic demand for electricity is advancing rapidly, and the sale of household apparatus has naturally gone up.

The total number of insured employés in July, 1934, was 257,830, compared with 243,770 in the preceding year.

It is highly probable that 1935 will witness an even greater expansion, and will prove to be a prosperous year for the British electrical manufacturing industry.

Reference is made to the House of Lords Electricity (Supply) Bill, No. 101, as amended in the Commons, which was dropped, and to the Electricity (Supply) Bill, No. 6, promoted by the Central Board in which suitable emendations were incorporated and which has since become law.

A number of private Acts were passed during the Session. In several instances powers to manufacture were sought under these Acts, and the Association, in co-operation with other interested bodies, was successful in securing adequate safeguards.

In August last a joint B.E.A.M.A.-E.L.M.A. Committee prepared a comprehensive memorandum for the Ministry of Transport in November last, drawing attention to the possibilities arising from the use of modern electric lamps and to recent advances in lighting technique.

The Association has taken an active part in the work of the I.E.E. Committee on electrical interference with broadcasting. Extensive work has been carried out by the E.R.A. in investigating the nature and magnitude of the radio interference arising from power installations and in ascertaining the best and most economical methods of correction.

In view of the increased importance conferred on the I.E.E. Regulations by the Electricity Commissioners, the Council has taken an active part in bringing about certain adjustments to meet the new conditions.

The Accessories Section has taken active steps to ensure that, in future, plugs and sockets used in connection with house-wiring shall be interchangeable. Other suggestions, which it was not possible to include in the tenth edition of the Regulations, have been made by the Sections dealing with accessories, switchgear and domestic appliances. The next edition is to be issued in about two years' time.

The National Convention

During 1934 the Council accepted an invitation from the I.M.E.A. to appoint representatives to the committee for the organisation of the National Electrical Convention. The directors, Messrs. Dunlop and Watlington, were nominated. An exhibition of household domestic appliances and accessories, together with street lighting and electro-farming equipment, will be held and it is proposed that the exhibits shall be limited, so far as is reasonably practicable, to new or improved forms of apparatus.

The Australian Government's tariff decisions announced at the end of last year were disappointing. They left the Australian manufacturer with a substantial advantage in price on all items, especially on dynamo-electric machines and transformers. The Council has lodged a protest in an endeavour to secure action more in accordance with the spirit of the Ottawa Agreement.

The Export Tariff Committee is preparing a formal application to the Canadian Tariff Board for a reduction of duties.

Agreement was reached on a list of British electrical machinery and apparatus not made in Poland with suitable revisions of the Polish tariff. The new Anglo-French Trade Treaty was completed during the year, the quotas being restored to their former values.

The attention of the Home Tariff Committee has been largely directed to reviewing the import position of electrical and allied goods. The imports of heating and cooking apparatus showed a tendency to rise, but it was considered that the time was not opportune for action. The switchgear figures showed a sudden but transient increase in May.

The Committee has been actively engaged in respect of some important classes of electrical goods which are being imported into the United Kingdom in increasing quantities. The complex nature of these goods, coupled with the variety of materials used in their manufacture, has caused difficulty in distinguishing " parts thereof " from parts of other apparatus. Applications are in course of preparation in respect of two further classes of electrical manufactures which are being imported into the country in increasing quantities.

Gratification is expressed at the issuing by the Minister of Health of model rules covering the special business of the making of municipal contracts and also the general business of municipal procedure.

Having regard to the onerous conditions accepted by makers of pumps (outside the Association) the Council decided to exempt, for twelve months, member pump makers and electrical manufacturers when tendering to pump contracts from their obligation to obtain the conditions laid down in the " Instruction to Members."

The Standardisation Committee has, during the year, dealt with a variety of subjects from the sectional technical committees. New problems resulting from experience gained with the overhead grid system have engaged their serious attention, one of the most important being the electrical stresses imposed on switchgear and transformers by h.f. impulse or surge voltages due to lightning and sudden disturbances.

Other matters dealt with were oil-immersed circuit-breakers, switchgear, transformers for power and lighting, instrument transformers, accessories, mercury-arc rectifiers, instruments, meters, and motor control gear.

After much preliminary work, a draft specification was prepared by Mr. J. A. B. Horsley, Electrical Inspector of Mines, and has been under discussion by him and the Mining Consultative Committee. This specification will, when issued, be authoritative in that the Government Testing Memorandum No. 4 will require compliance with that specification in the case of machines and appliances for use in mines.

Fair Trading

In a reference to the Fair Trading Council the report says that considerable progress has been made towards the completion of a number of draft schedules to the Policy. It is stated that hundreds of firms have signed the official acceptance form, indicating their agreement on general principles, including many of the leading non-association manufacturers within the scope of the Policy. The Accumulator Makers' Association and the Cable Makers' Association have confirmed their support of the Policy, and both associations are now represented on the Fair Trading Council. Negotiations are proceeding towards obtaining the support of the supply authorities, which, it is hoped, will reach a satisfactory conclusion at an early date. All indications point definitely to satisfaction throughout the electrical trade that a fair-trading policy is to be put into operation during the year.

Dealing with the reorganisation of the British Electrical Development Association, the report says that an E.D.A.-B.E.A.M.A. Co-operation Committee has been established, and, at the same time, the representatives of the B.E.A.M.A. have continued their membership of the technical and other committees in London. A local co-operation committee has been formed in most of the areas.

The Education Committee reports a rise in the number of overseas students employed in members' works at December 31st, 1934, from 158 to 197. Totals had been steadily dropping since 1929 when the figure was 243. India sent the greatest number of students, followed by Africa, Australia, New Zealand, Canada, China, British Guiana and the West Indies. The report refers to a number of other educational activities.

The I.M.E.A.-B.E.A.M.A. Joint Committee during the year dealt with a large number of questions affecting the two associations, and were able, in all cases, to reach agreement as to the requisite action.

Referring to the work of the Economic, Statistical, and Pub-

Correspondence

Correspondents should forward their communications as early as possible. No letter can be published unless we have the writer's name and address in our possession

Application Forms

With regard to the editorial remarks in your March 15th issue about application forms, I quite agree as to the foolishness of asking the prospective customer for a lot of technical details, of which he has not the least knowledge. A lady contemplating taking a supply once told me that she had taken the very elaborate forms sent her to her lawyer as she felt quite incapable of dealing with them.

You may be interested to know that I have used the enclosed application postcard for the past eight years since we started at Ashford, and that we have never been in any difficulty through cutting out the many elaborations generally used.

H. WILSON,
Ashford (Kent), *March 23rd.* *Electrical Engineer.*

[The application form referred to is a simple request for a supply "under the conditions issued by the Council, the Council's Special Order and the Electric Lighting Acts of 1882 to 1926." It contains, apart from a few headings for office use only, the information that the consumer will be charged for service cable in excess of 45 ft., that he is responsible for the safe-keeping of Council's apparatus on his property, and that the Council will not be responsible for permanent reinstatement on the consumer's property. All that the applicant has to do is to fill in the address of the premises in question, the name of his wiring contractor, and his own name.—EDS. ELEC. REV.]

The Engineer-Administrator

Many of us who are engaged in teaching engineering undergraduates are grateful for your editorial note on the discussion of Mr. Byng's I.E.E. paper. Judging by the reports in various periodicals, no one except the President seemed to have any appreciation of the difficulties under which full-time day teaching of engineering is carried on. I am in entire agreement with the theme of Mr. Byng's paper, and was myself a student at the first post-war course held on industrial administration, but I believe it is next to impossible to teach this subject effectively to students who have never worked in a factory—it tends to degenerate into mere "gas."

If we are to introduce more subjects into our curricula, why not add elocution and public speaking—one has only to attend an Institution discussion to realise such a desirability! Then there is physical training, surely an exceedingly important matter for young men in their late 'teens; in fact, we at Brighton have recently introduced two half-hours per week of corrective physical exercise instead of class-work for all our degree students, and the results appear to justify the change.

Participation in the social activities of a college is likely to be a far better preparation in the handling of men than hours of lectures on workshop management; a student who can control an assembly of his colleagues is a potential successful manager. What depresses many of us is the scant encouragement that such young men often have when they enter industry. Would that the I.E.E. or some such body could compel all engineering firms to follow the enlightened educational policies of such concerns as Metropolitan-Vickers, British Thomson-Houston, and Standard Telephones.

Brighton, *March 23rd.* EDWARD HUGHES.

An avenue of light at Heemstede, Holland, part of the illuminations during a fruit and flower exhibition

Small Joints

We were very interested in Mr. Taunton's article on this subject, especially his statement that whilst a married joint is as strong as the original cable, soldering reduces its flexibility, even so no force that would not break the wire will break the joint, but this cannot be said of the standard "midget" type of connector or small thimble connector.

As the makers of the "midget" connector, we entirely disagree, as we claim that if the connector is properly screwed on to the wires no force other than a force that will break

Better Times (*Continued from previous page*)

licity Departments, the report says that the value of complete and accurate statistics, covering such a wide range of goods as those made by B.E.A.M.A. manufacturers, was demonstrated, during the year, by frequent discussions with the Import Duties Advisory Committee on questions relating to United Kingdom tariffs.

It is stated that: "The annual report of the E.R.A. for 1933-34 is an encouraging document and carries good tidings to all members of that Association."

Mr. H. C. Siddeley, the B.E.A.M.A. delegate in the Argentine, returned to this country on the completion of his three years' appointment in that capacity. Those members who have been in close touch with Mr. Siddeley's efforts are satisfied that he has done excellent work. Even under the very adverse conditions that have prevailed they are of the opinion that the experiment was worth making, and that it will show its effects in the future.

The annual dinner of the Association will be held at the Connaught Rooms on November 21st, when the President, Lord Derby, will occupy the chair.

The Council acknowledges the assistance which the kindred associations have extended to the electrical manufacturing industry during the year.

Consideration has been given by the Council from time to time to the establishment of a staff pension and life assurance scheme, and a scheme was put into effect in February.

Mr. Railing's Speech

The annual meeting of the Association was held on March 21st, the chairman of the Council (Mr. M. J. Railing) presiding.

Pointing out how the industry had overcome the depression, Mr. Railing emphasised the fact that the number of persons engaged in electrical manufacture was higher than at any previous time in the history of the industry. Production of electrical machinery and apparatus was rapidly rising and the maintenance of domestic demand for electrical products, together with the industrial revival, which was now fairly general throughout the country, ensured that this demand was likely to increase.

The international situation gave ground for anxiety and the tariffs and other barriers which had been set up in the export markets made trading very difficult. But, on the whole, the recovery of British electrical exports was a testimony to the quality and value of their products. So long as the manufacturers were given reasonable guarantees of the home market such as the electrical industries of other nations enjoyed, they need never fear a repetition of the depression intensity of 1931. The general outlook was therefore brighter than it had been for some years.

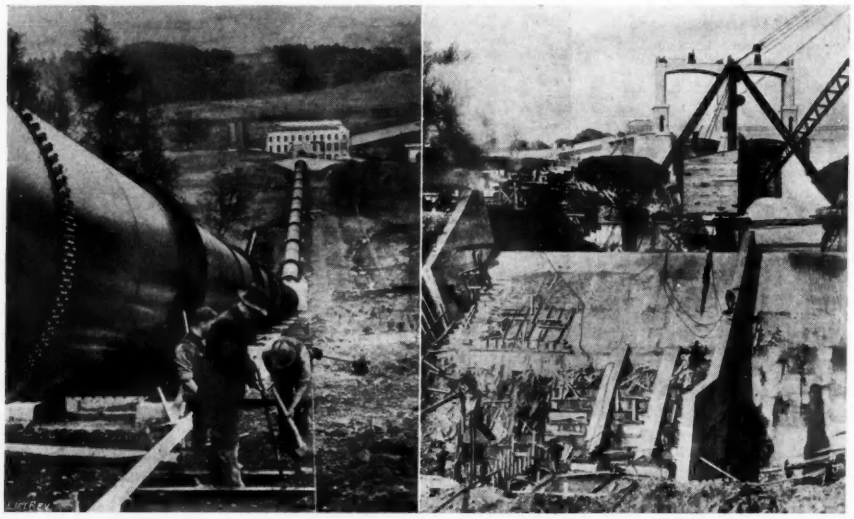
Progress had been made in the establishment of a Fair Trading Policy and it was hoped that before long it would be in successful operation. Close co-operation between the B.E.A.M.A. and the Electrical Development Association had been maintained through the Co-operation Committee which had been established.

The chairman announced that the following had been elected by ballot to fill vacancies on the Council: W. H. Allen, Sons & Co., Ltd.; British Thomson-Houston Co., Ltd.; Cromptor. Parkinson, Ltd.; General Electric Co., Ltd.; C. A. Parsons & Co., Ltd., and A. Reyrolle & Co., Ltd.

Later in the afternoon the Council met, when the following officers were elected: Chairman of Council, Mr. J. A. Hirst; vice-chairman, Mr. E. S. New; vice-president, Mr. M. J. Railing.

the wires will pull it out again. Further, the wire is neither flattened nor scarred, the only effect of screwing the connector on being a slight serration caused by the sharp edges of the internal thread. Further, due to the tapered shape of the interior of the connector, the wires are more rigidly held than under a binding screw.

As to the resistance of soldering *versus* connectors, a test carried out by Faraday House some time ago showed that after cutting a 3/.029 cable and jointing with a connector the resistance was increased by 0.00038 ohm; the tin was fairly bright and not cleaned.



The progress of the Galloway scheme. These photographs, taken last week, show a pipeline running down a hillside to the Glenlee power station and the channel for passing the flood waters from the Tongland reservoir to the river bed below the 70-ft.-high dam

Another independent authority carried out tests and reported that with wire properly cleaned and connected up with " midget " connectors the increase in resistance was 0.0002 ohm; with clean soldered joints the increase was 0.000175 ohm; and with wire not cleaned the increase was 0.0003 ohm.

We think that these tests confirm our statement that joints made with " midget " connectors are equal to married soldered joints; as no soldering is required, neither the flexibility of the wire is affected, nor the resistance increased. The connectors do not work loose, and the joint is efficiently insulated.

We hope that when Mr. Taunton comes across an installation in which " midget " connectors have been used he will not condemn it as unsatisfactory, or as a criterion of bad workmanship. V.G. MANUFACTURING CO., LTD.,

London, N.W.10, *March 22nd.* J. MARTIN BLAIR, *Director.*

With reference to Mr. Taunton's article in your issue of March 22nd, I may say that I have long since refrained from the use of mechanical connectors for small cables because I traced faults which had been caused by the use of these " gadgets." The good electrician knows that good contact must be established, and consequently he is naturally inclined to give his screwdriver that extra turn, which causes the pinching screw to bite into one or more of the small wires.

Apart altogether from the foregoing disadvantage of small connectors, I am of opinion that there is no type of connection so satisfactory as a properly made soldered joint, but, of course, care has to be exercised in the selection of a non-corrosive flux. In the past I have come across instances of defective dry joints which were only detected by the smell of burning rubber.

I am of the opinion that no mechanical connectors should be used unless circumstances allow of no other method of jointing. I would go a little further and state that all bonds and earths should be properly soldered, and on metal-sheathed systems I have this rigidly put into practice, except, of course, that it is often not practicable to solder the actual earth point.

Mr. Taunton refers to his question as " trifling," but, on the contrary, I feel that the question is of extreme importance because we have an appalling number of people in our midst who would carry out wiring with string if it would conduct current. A. MILNE.

Glasgow, *March 23rd.*

The subject dealt with by Mr. Taunton is one which merits a standard being set up by an authoritative body, although I believe the I.E.E. Wiring Rules stipulate soldered joints.

Soldered contacts increase the conductivity of the joint and eliminate that distortion and bruising of the strand which occurs when porcelain connectors are used; they also eliminate and heating set up by increased resistance. Where flexibles are connected to hard wires, connections must only be made by means of screw terminals in junction boxes, &c.

Most small conductors are insulated with a sulphurous dielectric, necessitating the tinning of the wires. The use of screw connectors bruises and cracks the protective coat of tin, and unless the joint is absolutely airtight corrosion is set up.

Porcelain connectors and ferrules are designed principally for the unskilled man. The sweating or soldering of two small conductors is not so simple as at first appears. Excessive heat at the point of fusion creates brittleness at the extreme ends of the joints and too liberal a use of solder reduces the tensile strength.

The copper bit employed should be of sufficient weight for the size of work and should be grooved along both axes to a depth slightly in excess of the size of the conductor. This allows the conductor to be submerged in the solder when the groove is full. An all-important point in the use of the copper bit is to ensure that it is always completely and efficiently tinned on all sides and the grooves: use resin only as a flux, and a solder whose components are lead 8 parts, tin 4 parts, and bismuth 15 parts, melting at 150 deg. F. The copper bit must never be allowed to get red hot, otherwise the tinning will be burned off. The skilled man can gauge its heat almost to a degree.

After interlacing the strand into position, cover with powdered resin and apply the copper bit, which has been previously heated and floated over with the solder. A few seconds' application will suffice to fill the interstices and unite the two conductors with a film of solder, without raising the temperature of the adjoining parts to create brittleness. The secret lies in clean preparation and the quick manipulation of the heat. Knack, of course, plays a big part.

The blow-pipe is a very useful tool for this work, but only in the hands of the skilled man. The man who can create just the right flame and heat for the job on hand raises the temperature of the joint to a uniform heat, fluxes with resin, and films the joint by means of a bar of the solder—rather a more difficult feat than the previous one.

Even in the jointing of large cables it is generally agreed that interlacing and sweating the wires is to be preferred when the skill of the workman is beyond question. When the workman cannot be absolutely relied on, it is better to use mechanical fittings, which combine simplicity with a doubtful efficiency. WILLIAM MASKERY.

Brighton, *March 24th.*

Earth Leakage Potentials

In his article in your issue of March 22nd Mr. Gilbert comments unfavourably upon the use of a neutral conductor as a medium for earthing a consumer's apparatus on the grounds that no allowance is made for a neutral-earth p.d. due to unbalanced load and that protective apparatus becomes inoperative should a neutral be disconnected between transformer and consumer.

If any engineer cares to call on me I shall be very pleased to demonstrate that a relay directly controlling the trip mechanism of a 50-A switch can be connected between a neutral conductor and consumers' apparatus; that the relay will compensate for neutral-earth p.d. but will operate if, in spite of the consumers' apparatus being independently earthed, a leakage from phase causes more than a small volt rise between consumers' apparatus and earth; and that the same relay will operate if the neutral conductor is disconnected and a leakage from consumers' apparatus to earth exceeds 0.5 A or if the total leakage from earth to neutral—possibly due to stray leakage currents—exceeds 1 A.

There is not nearly so much difficulty in providing suitable protective apparatus as there is in meeting complicated regulations. The Commissioners' Regulations permit a neutral to be earthed only at one point; if a relay is connected between consumers' apparatus and neutral already earthed at a transformer station is this a breach of Regulation 4 (a)?

Mr. Gilbert rightly points out that the main function of earth leakage apparatus is to prevent dangerous potentials on consumers' apparatus, and states that leakage currents of 50 to 100 mA are of small importance, provided the potential is kept low. The difficulty is that I.E.E. Reg. 1,005 places the limit of leakage current at 30 mA and ignores volt rise. The energy—about 1.5 W—required for directly-operated as distinct from relay-operated trip mechanism is preferably obtained at 0.5 A at 3 V rather than at 0.03 A at 50 V between consumers' apparatus and earth.

Mr. Gilbert mentions the need for sub-station switches in conjunction with consumers' switches, but with rural services there is this difficulty: a transformer may be used to supply, for example, three farms, connected between different phases and neutral. Now the Commissioners' Regulations apply between the transformer and the farms, but the I.E.E. Regulations apply to the installation beyond the farm meters. The effect is that for the farm installation the neutral cannot be used as an earthing medium, but in a town area, with extensive water mains, the earth connection of a neutral may be made, for example, to a factory water-pipe system which provides an adequate leakage current path. This instance indicates the need for defining the line of demarcation between the Commissioners' and the I.E.E. Regulations in the case of rural supplies. The inventor is placed in an impossible position because he is not only bound to make his apparatus conform to a straightforward Ohm's law, but in addition he must make Ohm's law comply with the various regulations.

Liverpool, *March 23rd.* A. G. BULLEN,
Managing Director, Patents Management Co., Ltd.

Silk Singeing Frames

I should be obliged if you or any of your readers could supply me with the address of any firms manufacturing electric singeing frames suitable for spun silk.

I should also like to know the opinion of any reader who has had experience with these frames.

Manchester, *March 20th.* GEO. C. MILNES.

Earthing by Water Pipes

The following is an extract taken from a letter written by an authority on electrical matters in reply to a query regarding the suitability of a water-piping system as an earth electrode where a portion of the piping system was not filled with water. Our contention was that the suitability of a water-pipe system as an earth electrode was not dependent on whether the pipe was filled with water or not, but on the area of the external pipe in connection with the general surrounding mass of earth:—

"Rule 45 (a) definitely states that earthing shall be made to a 'convenient water pipe.'" He adds the following quotation from an applicable section of the report of a Sub-committee of the Institution of Electrical Engineers on the question of earthing: "Where special earth plates are not provided extreme care must be taken to see that only such earths are used as are easily capable of carrying the maximum current which can be allowed to flow by the largest fuse used in the circuit in question. From this point of view, water pipes directly in connection with street water mains are definitely recommended." And he says: "It will be seen from the above that any water pipe, whether connected to a street water main or other supply, should, in any case, be filled with water."

We are hardly inclined to think that the above constitutes conclusive proof, and the views of your readers would be of interest. BROWN & CO., LTD.,
A. L. THOM, *Electrical Engineer.*

Colombo, Ceylon, *March 6th.*

Long-lived Electrical Machinery

In the note on this subject in your current issue you refer to the two 60-kW 83⅓-cycle Darjeeling machines, born 1896 and still going strong. I think it is due to the makers, and to my old friend Brunton, who designed these wooden-cored rotors, to state that within a year of their installation they, together with the whole power house, were completely overwhelmed by a huge landslide which blocked the channel of one of the streams and diverted it on to the building.

When we succeeded in reaching the spot there was six feet of mud over the 2,000-V alternators and switchboard. After digging out the debris and washing the whole place with pressure water from the pipe line, charcoal fires were maintained; and in six weeks from the catastrophe, after a final drying on short-circuit, the supply recommenced as though nothing had happened. J. W. MEARES.

Chichester, *March 22nd.*

Does Registration Mean Anything?

May I ask a few questions regarding registration?

What legal authority have corporations for confining assisted-wiring schemes to registered contractors? Since all contractors are ratepayers and have to abide by the same set of rules, what difference can registration make? If any tinker, tailor, soldier or sailor can become a registered contractor by simply employing a qualified man until he is registered (and carry on without his services afterward) what value does registration offer?

The price quoted by registered contractors on corporation and private building schemes is 7s. to the same specification as that required on assisted-wiring schemes, for which they are paid 18s. Apparently registration, instead of eliminating "cutting," has enabled registered contractors to make money in order that they can cut on "free" schemes.

I am against registration until such time as only the man who has served a proper apprenticeship and has at least attended a technical centre for the same period is eligible for registration. To-day many contractors are merely employers of boy labour, which means a blind-alley occupation for the lads who enter the trade. My contention is that all work should be handed out to those contractors whose price permits of a sound job and who, to the knowledge of the departments concerned, carry out their work in a proper manner, which is by no means always the case with registered contractors. CONTRACTOR.

March 19th.

[We regret that by a printer's omission the second letter on "Safety in Theatres" in our last issue was unsigned. The writer was Mr. W. H. Hind (Liverpool).—EDS., ELECTRICAL REVIEW.]

Swedish Travelling Sub-stations

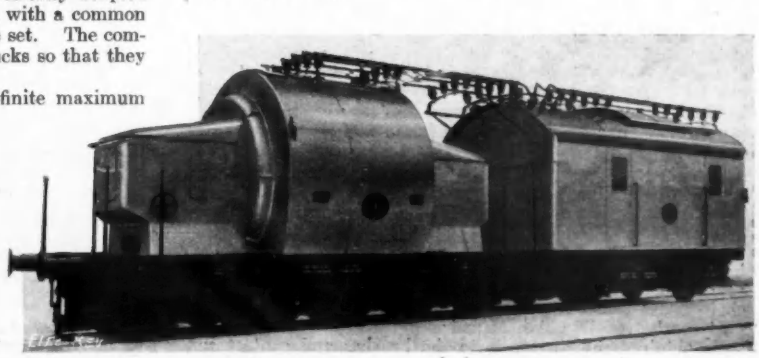
AN important part of the equipment supplied by the A.S.E.A. Co. of Västeras, in connection with the electrification of the Stockholm-Ange section of the Swedish State railways consisted of twenty-three travelling frequency convertors to transform three-phase, 50 cycle power to single-phase 16⅔ cycle a.c. for the overhead contact lines.

Each convertor unit has a synchronous three-phase motor of 3,200 kVA, 6,300 V, to which is connected a 2,400-kVA, 3,000-V synchronous single-phase generator and two directly coupled 115-V exciters. The machines are constructed with a common shaft and two bearings, one at each end of the set. The complete units are mounted on special railway trucks so that they can easily be moved as required.

Particular care was taken to see that a definite maximum weight of 86 tons was not exceeded, this being one of the deciding factors in the adoption of welded construction. Each vehicle, which constitutes the bedplate of the motor-generator, is provided with five axles and consists of frames made from 30-mm. heat-treated boiler plate in which slots for the horn blocks are cut. Round these the horn plates guiding the axle boxes are welded.

The upper edges of the frame plates are provided with 50 by 180-mm. welded-on bars, which serve as supports for the stators. In addition, I-section stays beams are welded between the frames at suitable points for the support of the more important parts of the machinery. A foot-plate for the inspection of all parts runs round the top of the frame.

Four welded lifting brackets are secured to the underside of the frames, these serving either for the appplication of lifting bolts when the equipment has to be raised by a crane, or for the application of jacks. All welded joints were made with A.S.E.A. type-ZA coated electrodes, with a core diameter of from 4 to 7 mm.



One of the convertor sub-stations

D

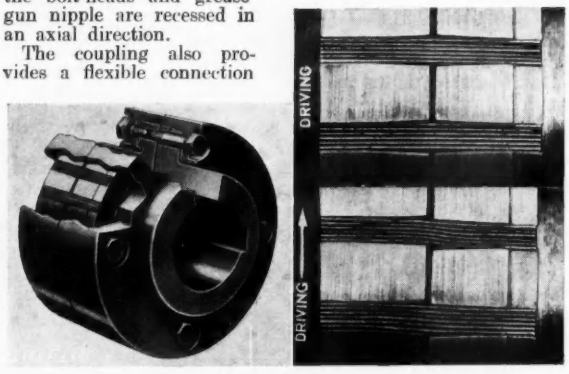
New Apparatus and Devices

for Domestic, Cooking and Heating, Lighting, Power and Scientific Purposes

Flexible Couplings

A new coupling of the flexible spring pattern has been introduced by the British Thomson-Houston Co., Ltd., Rugby, to reduce unequal loading of shafts and bearings due to errors of alignment. The exterior of the coupling is smooth, and the bolt-heads and grease-gun nipple are recessed in an axial direction.

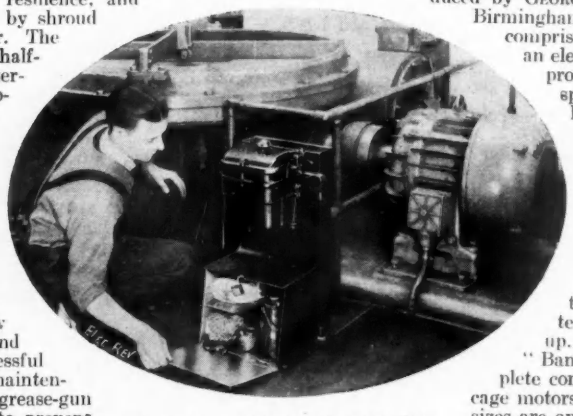
The coupling also provides a flexible connection between driving and driven machines subjected to shock and vibration (especially when toothed metal gears of the helical type are used) and permits the gears to adjust themselves axially.



The B.T.H. flexible coupling partly broken away to show the construction, and a view of the lamination, with (top) the coupling at rest, and (below) subjected to maximum overload

The components consist of driving and driven hubs connected by laminated springs arranged in axial slots. The slots are shaped so that the springs are adequately supported while retaining their resilience, and are held in position in the slots by shroud rings which are spigoted together. The shroud ring over the driven half-coupling is located from its counterpart on the driving half-coupling, and makes no contact with the driven hub.

The slots are so shaped that at "no-load" there is a vee-gap between the springs and the slot walls, which closes up on the "driving" and "driven" faces, extending the active load-bearing surface of each spring inwards as the torque increases. The driving portion can be uncoupled simply by parting the shroud rings and removing the springs. As successful functioning depends upon the maintenance of adequate lubrication, a grease-gun nipple and a soft packing ring to prevent egress of grease past the driven hub are provided.



The Ellison "Bantam" works tidy

A New Departure in Grillers

We recently examined a new type of electric griller, claimed to have many of the characteristics of a coke grill, which Carron Company, Carron, Falkirk, is marketing. The food is placed on a grooved brander plate heated on the underside to seal the meat, while there is a radiant heater above. The brander plate is designed for easy withdrawal to facilitate inspection, reloading and turning the food. The standard model measures 24 in. wide by 16 in. deep, and the total loading of each compartment is 11 kW.

Stop Watches

Messrs. A. Arnold & Co., 122, St. John Street, London, E.C.1, have sent us one of their new low-priced stop-watches. This resembles an ordinary watch with a large seconds hand almost the same length as the diameter of the dial. It can be stopped instantaneously by depressing the winding button. The watch restarts as soon as pressure on the button is released. Readings down to a fraction of a second can be obtained.

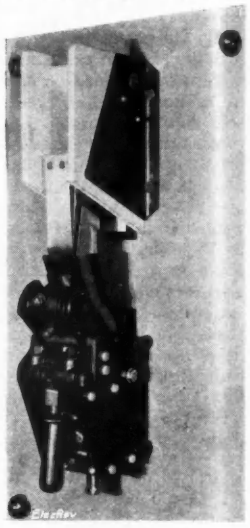
Air-break Switchgear

The "chain-link" series of a.c. and d.c. circuit-breakers introduced by the Igranic Electric Co., Ltd., 149, Queen Victoria Street, London, E.C.4, embodies the main features of the firm's older air-break models, but the operating mechanism has been considerably simplified. The most notable modification is the substitution of a short length of standard steel-roller chain and toggle-links, thus providing that an important spare part can be readily obtained and easily fitted.

To obtain complete access to the brushes and contact surfaces it is only necessary to slacken two screws, remove one nut and withdraw a pivot pin preparatory to lifting forward the brush assembly. This then rests on the front of the breaker so as to present the full length and both surfaces of the laminated brush for inspection and cleaning. The fixed contacts are also as fully exposed. Brush pressure is adjusted by rotating the front operating pivot, which is normally held in position by two set screws. Equalisation of brush pressure is secured by slackening two nuts and re-tightening them after closing the switch.

The breakers are loose-handled under all operating conditions and the trip gear is designed to secure the same immunity from tumble due to vibration or shock that has characterised the company's earlier models. Shunt trip coils can be fitted for remote control. Low-voltage trips normally set for 50 per cent. of full voltage and directional trips set at 20 per cent. reverse current can be incorporated.

These chain-link circuit-breakers are available as single-, double- and triple-pole units of the open or enclosed type, and from 30 to 600 A up to 660 V.



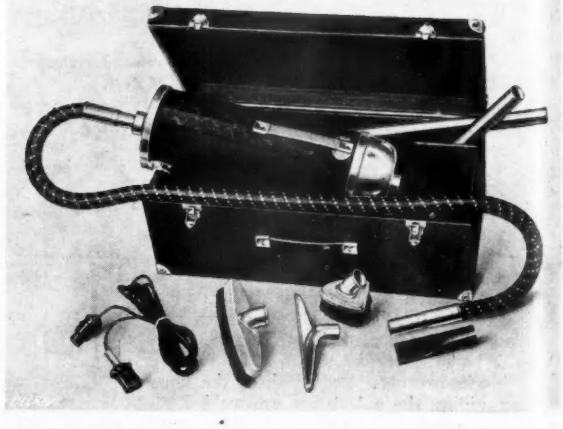
The new Igranic chain-link circuit-breaker

Combined Locker and Motor Starter

An unusual combination which has been recently introduced by George Ellison, Ltd., Perry Barr, Birmingham, 20, is a "works tidy." This comprises a pedestal stand fitted with an electric motor starter and a vermin-proof cupboard in which machine spares, tools and personal belongings can be locked away safely. The base plate is constructed to stand firmly on the floor despite any unevenness, and cables in conduit or flexible pipe can be taken to entrances at either side or at the back of the breaker; cover plates are provided for the unused entrances. Removal of the breaker cover exposes all terminals ready for connecting up. The model illustrated is the "Bantam" which provides complete control and protection for squirrel-cage motors up to about 12 h.p., but larger sizes are available.

Relieving Cutters

Last week we referred to the "Challice corrected straight-line relief" in connection with new hobs and cutters to be marketed by Messrs. Edgar Allen & Co., Ltd. The word "Challice," however, should have read "Challier," which is the name of the inventor.



The "Summit" vacuum cleaner, with accessories illustrated, is a new product of the Sloan Electrical Co., Ltd. Green bakelite is used for the casing and a B.T.H. motor is fitted

Wise Buying. By H. Southall

SUCCESSFUL trading depends on three agencies: wise buying, economic production, and effective selling. In order of natural sequence buying comes first, but in municipal trading departments it generally ranks last in order of importance. The reason for this is obscure; in these days when every effort is being made to restore economic prosperity the question of buying cannot be lightly ignored.

Every municipal electricity undertaking which has or has had a generating station knows something about economic production, but nowadays the Central Electricity Board is responsible for securing the economic generation of most of the country's electricity requirements. This fact, official entreaties, the publication of numerous articles in the electrical Press, and the oral inspirations of the leaders of the supply industry, have caused practically every authority to take interest in selling.

Two of the essential factors in successful trading are, therefore, catered for, but in the remaining department quite a lot may yet be done. The view is advanced that in every municipal electricity undertaking where upwards of £75,000 per annum is expended on materials and (purchased) services, a competent buyer could justify his engagement by saving many times per annum the substantial salary which such a man in such a position would deserve.

Supply Undertakings Need Buyers

If inquiries were instituted amongst one hundred commercial or manufacturing concerns and one hundred municipal undertakings each with an annual purchasing figure of or more than £75,000, it would probably be found that in the large majority of the former cases a competent buyer would be employed, whilst in a majority of the latter cases purchasing methods likely to bring ruin to any business unprotected by monopoly would be found to exist.

It may be argued that the recent recommendations made by the Ministry of Health, largely adopted by municipalities, with regard to the purchase of materials in quantities, tends to lessen the need of a buyer. Actually the reverse is the case, for the public advertisement of requirements, desirable though it may be, opens the door to firms of small repute offering inferior goods at prices calculated low enough to attract inexperienced but well-meaning committeemen into accepting tenders on price only. Undertakings, their consumers, and their staffs need protection against this, and a capable buyer, in collaboration with other officials, could build the necessary barrier.

Unless the right goods are bought at the right price economic production is impossible and effective selling becomes highly improbable. A study of bankruptcy cases will show that more private businesses fail through incautious buying than any other cause.

Theoretically, it should be possible to realise the book value of stock if the necessity for sale should arise. Wise buying permits this happy state of affairs with the minimum amount charged to depreciation: depreciation is a matter of business honesty. To those concerned the suggestion is offered that it pays to look deeply into the question of stocks and their actual value and the effect that sound buying has on them.

The duties of a buyer call for a combined knowledge of cost, quality, price, value and general commercial economics. Whenever goods are to be bought the buyer is placed in an advantageous position if he has some idea of the price at which the goods can be produced. By considering cost of production, quality and price quoted, he can arrive at value; value is the most important factor, for "cheap" goods can be dear and expensive goods can be cheap.

Economic Values

Every commodity and service has an economic value. Materials required for permanent service where maintenance costs will ensue must be of high quality, but there is a definite economic limit to the price they are worth. Materials required for a temporary purpose need only reach a reasonable standard of quality; the buyer, in collaboration with the official concerned in their use, would fix the standard.

There are numerous requirements in an electricity department uncovered by British Standard Specifications, and it is desirable that these should be purchased partly on the reputation of the supplier and partly by means of the trial order system. It never pays to ignore small firms, for such concerns specialising in a few lines can sometimes offer better value than some of the large firms who are dealing in or manufacturing hundreds of different lines. The buyer must always protect himself and his employers by exacting stringent guarantees when dealing with small firms; large firms rarely jeopardise their reputations by supplying inferior goods.

An experienced buyer with an intimate knowledge of requirements can exploit the advantages of bulk buying to the fullest extent; in buying requirements for long periods at one time lower prices can be obtained, clerical labour is reduced, and in many cases free transit can be secured.

The buyer's knowledge of commercial economics will guide him in ascertaining the safe amount of money available for investment in stocks. Buying is one of the easiest tasks to perform, especially when other people's money is being spent. Wise buying is a most difficult duty, for there are so many to satisfy, so many in a position to criticise, and too many pitfalls which only the astute can avoid.

Electrical Reference Libraries. By "Economist"

HOW many large electricity departments or companies have in their main offices an appropriate reference library? I do not mean a very large number of books, the majority of which are out of date, on matters pertaining to the elements of electrical engineering. The electrical undertaking should not attempt to compete with the municipal library.

No doubt each departmental head has in his office a number of books on matters in which he is particularly interested, but it is left to the individual to decide whether or not he makes use of them. That small library is purely personal; it is of no use to the undertaking as a whole and there is neither pooling of material nor co-ordination of resources. Even if there is a complete set of all-important technical books in a situation convenient for ready access by interested people, however, something more is required. Text-books are always written after the event. By the time a new development has reached the text-book stage it is no longer new. Moreover, a busy engineer may have little time in which to study publishers' lists and to read fresh books in the hope that there will be something in them of assistance in his work. He needs to have fresh developments brought to his notice as quickly as possible and without spending hours searching.

Value of Technical Periodicals

Undoubtedly "news" in the industry is obtained from the technical Press. As the periodicals are received they are read or glanced through, perhaps certain items are commented upon, or if routine duties are particularly pressing they are placed aside to be read later. "Later" may never arrive, and a large amount of useful information is wasted. A few months afterwards a particular problem crops up; it may be a technical problem, one connected with some new way of increasing sales, or an item of news about some other undertaking. The engineer interested will say, "I saw something about that somewhere. I believe it was in the ———. I can't remember it at the moment, but I'll see if I can lay my hands on the article." Perhaps he looks for it—perhaps not; the paper is lost or destroyed, and when it is too late he wishes he had kept it.

What is Required

Each undertaking ought to have some system whereby matters of urgent importance are kept for future reference. Nothing elaborate is required, and the small time devoted to keeping matters of real use will be well repaid in the increased knowledge and efficiency that will result from it. Copies of each journal should be passed on to the principal departments and initialled by the chief officer after he has taken note of anything of value to him, and at a later date they should be returned to the person responsible for keeping the information.

Either of two methods of filing may be adopted. The articles may be cut out of the journals and filed away under suitable headings, all material referring to the same subject matter being kept together in the same file so that if information is required about, say, new cooker developments, all that it is necessary to do is to consult the file on "Cookers." One disadvantage of cutting out the articles is that there may be separate and important articles on each side of a page, and filing one in a particular place will cause the other to be overlooked. The remedy for this, of course, is to have two copies instead of one.

Alternatively, all periodicals may be filed on shelves intact and a card index system introduced which will give the title of each article required, the cards being filed in subject headings. When information is required reference will be made to the cards and the appropriate journals taken down from the shelves. If the problem of classification presents any difficulties, observation of the system adopted at the local public library will be of great assistance.

In the Courts

IN the King's Bench Division on March 20th Mr. Justice Greaves-Lord had before him an action by Marconi's Wireless Telegraph Co., Ltd., the Gramophone Co., Ltd., and Standard Telephones & Cables, Ltd., against British Lumophon, Ltd.

When the case was called on Mr. Lloyd Jacobs said he had acted for the defendant company, but it was now in liquidation and he had no instructions to appear for it. Mr. Swords, K.C., for the plaintiffs, said it was a voluntary liquidation and made no difference.

He said that the plaintiffs were owners of wireless inventions and patent rights and the defendants were manufacturers and obtained a licence to manufacture subject to payment of royalties. Accounts were rendered down to a time when £600 was payable to the plaintiffs, and it had never been paid and other amounts also became due.

After hearing evidence His Lordship gave judgment for the plaintiffs and ordered an account of royalties to be taken on the footing that the defendants were not entitled to exclude the goods supplied by them to licensees of the plaintiffs or imported from abroad.

Costs Against Council

The hearing was resumed at Bow County Court on Monday before Judge Thompson, K.C., of the case in which Mr. H. Joseph, an estate agent, claimed for an injunction and damages against the East Ham Borough Council for cutting off his electric light following a dispute over an electricity account. The original proceedings were reported in the ELECTRICAL REVIEW, February 22nd, page 280.

On behalf of the Council evidence was given that it was impossible for the plaintiff's meter to go wrong more than 5 per cent., and that it was electrically impossible for it to go wrong 165 per cent. as he had suggested.

Mr. Jackson, for the Council, said that if the meter was not referred to the Electricity Commissioners and an inspector appointed then the final arbiter was the meter. It had to be remembered that the meter was thoroughly tested officially before being used. If anything went wrong there was a special tribunal to settle the matter.

Judge Thompson: Why was not the plaintiff told to go to the inspector? Is there a limited time in which he is to put into operation his appeal to the inspector?

Mr. Jackson: Nothing but a reasonable time. Plaintiff had more than a reasonable time from June to November.

Mr. Jackson later stated that the Council had offered to test this meter four times, at which Judge Thompson observed that plaintiff had apparently been offered everybody but the right person to test his meter. The Judge also commented upon the fact that plaintiff had paid his September account while the dispute over the June account was proceeding, and that he had offered to give £5 to any charity on a £2 10s. dispute.

Giving judgment, Judge Thompson said the main point was whether there was a *bona fide* dispute, and he had to find that there was because the meter had registered 2½ times the amount recorded for the corresponding period of the previous year. Plaintiff was disconnected for only twenty-four hours, but he had to go to the High Court to ask for an injunction, upon which the defendants undertoook to reconnect him and did so. It was abundantly clear that plaintiff was entitled to the relief asked for, but he also had to find that it was not within his province to say whether the meter was accurate or not.

Judgment was given for the plaintiff for all the costs of the action in the High Court and in the County Court on scale "B," and he gave leave for an injunction to be applied for by the plaintiff at any moment it was desired.

Leave to appeal was granted.

Unlicensed Radio Transmitter

George John Jenner, jun., of Hadlow, Kent, was fined £2 at Tonbridge Police Court last week for operating a radio-transmitting apparatus without a licence between February 1st and 25th.

It was stated for the prosecution that direction-finding apparatus had disclosed an oscillator with gramophone attachment at the defendant's house, the apparatus having been used on two occasions. The range of the apparatus as used was said to be about half a mile, but with an outside aerial about five miles

The defendant said that the apparatus cost 15s. and was purely for experimental purposes. He did not think it could be heard outside the building.

Jenner was fined as stated and an order made for the forfeiture of the apparatus.

Winding-up Petition Again Adjourned

In the Companies' Court on March 25th Mr. Justice Bennett had again before him the petition of the Electrical Press, Ltd., for the winding-up of Cliffdown Appliances, Ltd. When the petition was before his Lordship on March 18th it was stated by counsel that the petitioning company was a judgment creditor for £60 and that its petition was supported by another creditor for £35. Counsel stated that the debtor company was making an offer and the petition was accordingly adjourned.

Counsel again applied for an adjournment and his Lordship assented to the hearing of the petition being held over until April 8th next.

Parliamentary News (BY OUR SPECIAL REPORTER)

ON March 20th Mr. D. G. Somerville asked the Minister of Transport if he could state what approximate proportion of the total output of electricity in this country was now supplied in the form of alternating current; and by what date he anticipated that all consumers in the Greater London area would have a supply of alternating current available.

Mr. Hore-Belisha said that the proportion of the total public supply to consumers given as alternating current was of the order of 80 per cent. There was no statutory obligation on those giving d.c. supplies to change over.

Dartford's Withdrawal from District Council

On March 20th Mr. Parkinson asked the Minister of Labour if his attention had been directed to the action of the Dartford Borough Council in withdrawing from the District Joint Industrial Council for the Electricity Supply Industry (Greater London Area No. 10); and if so, what action he proposed to take in bringing pressure to bear upon the Council to honour the scale of salaries laid down by the Joint Industrial Council for its employés.

Mr. R. S. Hudson said he understood that the Dartford Borough Council had recently decided to withdraw from the Joint Industrial Council in question, but he had been informed that the matter had not yet been considered by the latter body.

The Folkestone Electricity Bill

This Bill passed its third reading in the House of Commons on March 20th and was read a first time in the House of Lords on the same day.

The National Register

THE report of the Executive Committee of the National Register of Electrical Installation Contractors for the year ended December 31st last (which is to be presented at the annual meeting on April 5th) refers to the death of Mr. T. Trimnell, who had been solicitor and secretary to the Register from its inception.

The accounts show a considerably increased revenue owing to the doubling of the annual renewal fee (now £2 2s.) and the larger application fee. The engagement of an additional inspector has led to an increase on the expenditure side, too. The balance on the revenue account is £1,190 against £457, but it is pointed out that had the second inspector been employed throughout the year this would have been reduced to £500 or £600. The annual renewal fees are still insufficient by themselves to cover the normal annual expenses.

During the year 262 applications for registration were received. Of these 101 were accepted, fifty-eight were declined, and thirteen were withdrawn, while ninety were still under investigation at the end of the year. The net number now on the register is 1,724—an increase of thirty during the year.

The two inspectors (Messrs. H. C. Hazel and E. H. Whatton) have been very active not only inspecting work by registered contractors but also that of applicants for registration. New premises were secured in the I.E.E. building during the year, and a Scottish Centre was also set up.

The increase in renewal fees is said to have had little effect upon the renewal of certificates. Sixty contractors failed to renew their certificates without giving specific reasons and only two because of the increase in the fee. The number of applications was only very slightly below the average. Halifax and Carlisle have decided to restrict their assisted wiring work to registered contractors, bringing the total number of authorities in this category up to twenty-three.

The 123 scrutinising committees have operated smoothly during the year; it is hoped that the policy of inspecting applicants' work will ease their labours. The Scrutinising Committee has also acted as an Inspection Committee and the Executive Committee records its appreciation of the work of the members—Messrs. Cash and Calvert. Thanks to Mr. P. V. Hunter, the chairman of the Executive Committee, are also expressed.

Appended to the report is a report on the inspection of work during the year. Altogether the work of 339 contractors in all parts of the country was inspected, including that of 117 applicants for registration. As a result seven contractors were struck off the Register. The report contains a list of definite breaches of proper wiring practice which have been discovered, due generally to ignorance of proper practice and sometimes to inadequate supervision. It is considered that the inspection system has a definite educational value and it is hoped that in course of time the work of all contractors on the Register will be inspected.

Business and Industrial Notes

The Week's Electrical Trade News from all Sources. Commercial and Industrial Developments. Business Changes, Market Prices for Materials, Trade Openings, New Publicity Literature, Liquidations, and Failures

American Lamp Prices

The New York correspondent of the *Financial News* reported on Friday last that the General Electric Co. (U.S.) had cut most of its lamp prices by over 20 per cent. The same paper remarked on Tuesday that further information must be awaited regarding the motives that prompted this somewhat sensational move, adding that "it should be considered in conjunction with the fact that the company's profits as a whole jumped 58 per cent. in 1934, while sales only increased by 21 per cent."

A Pyrometer Demonstration

On March 27th, the Manchester Corporation Electricity Department commenced a demonstration of electrical pyrometer equipment and heat treatment plant at its demonstration workshop. By arrangement with the Foster Instrument Co., a comprehensive range of industrial and research instruments are being demonstrated, including indicating and recording thermo-couple and radiation pyrometers, single- and double-range optical pyrometers of the disappearing filament type, foundry pyrometers, and automatic temperature controllers for use with all types of heat-treatment furnaces. The pyrometric equipment is being demonstrated in use on electrically heated furnaces supplied by Wild-Barfield Electric Furnaces, Ltd., and the following types are shown:—Automatic hardening furnace for steel hardening; forced air circulation furnace for tempering, secondary hardening, &c.; box-type furnace for carburising, annealing, vitreous enamelling, &c.; high temperature furnace for high speed steel, &c.; and a selection of small electric muffles for laboratories. The demonstration concludes on April 6th.

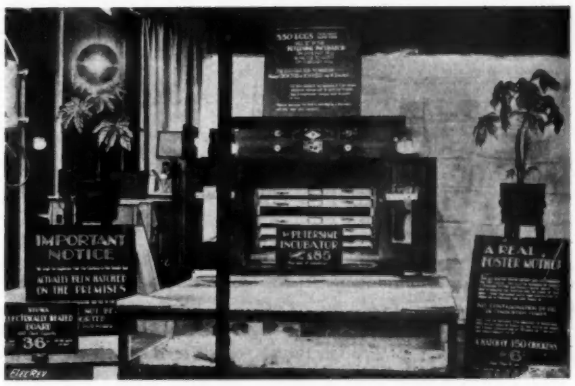
An E.D.A. Demonstrators' Course

The 1935 course for senior demonstrators and saleswomen in the electrical industry, which has been arranged by E.D.A., the E.A.W., and E.L.M.A., will be held in London from April 3rd to 5th. The meeting will take place at the E.A.W. headquarters, excepting the morning session of the last day, which will be held at the Lighting Service Bureau. The speakers will be Miss C. Haslett, Miss A. A. Stemp, Miss D. Vaughan, Miss E. D. Lockley and Miss H. Shaw, Sir William Ray, and Messrs. P. C. Honey, J. I. Bernard, W. J. Jones, H. Lingard, and H. Quigley, and subjects to be covered will include electricity on the farm, water heating, cooking, lighting, and the organisation and training of demonstrating staff. On April 6th a visit will be paid to the Ideal Home Exhibition to view the electrical exhibits there.

A Factory Extension

The extensions to the factory of the Young Accumulator Co. (1929), Ltd., on the Kingston By-Pass Road at New Malden, were officially inaugurated last week by Lord Howe. The extension is a new building erected near the company's older factory, and it is devoted to office accommodation, despatch stores, and joinery sections. Manufacture proper is being continued in the original building, but with the establishment of the extensions there has been a reorganisation of the works to deal with increased production. The whole of the building is of fire-proof construction on a steel frame, and the rear wall of the works section is temporary to allow for further extension.

During a recent brief tour of the works we traced the manufacture of the accumulator from the casting shop, where antimonial lead is melted and cast into grids; through pasting shops, where lead oxides are mixed and hand pasted on to the grids; through the formation room, where the positive and negative plates are formed by continuous day and night electrolysis; to the assembly shop, where the plates are jig mounted while the lugs, bus-bars and terminal posts are joined into a homogeneous whole. Final operations include inserting the separators between the plates, placing the plate units into the composition or ebonite boxes, welding the connector bars and securing lids fitted with rubber rings and locking nuts by running bituminous compound round the edges and sides of the cells and battery box. The company has announced the introduction of a new "Super-Armoured" battery.



The Young Accumulator Company's works extensions

Electricity in Poultry Farming

Blackburn Corporation Electricity Department has considerably extended its supply of electricity to rural areas of late, and dairy and poultry farmers have been connected up at a specially low tariff. The supply is provided on one meter, charges being based on a two-rate tariff consisting of a fixed quarterly payment plus ¾d. per kWh for the first 480 kWh per quarter.

A display of electrical poultry farming apparatus at Blackburn

Above 480 kWh the charge is ¼d. per kWh. A recent demonstration of poultry appliances, incubators, hovers, &c., shown in the illustration, created considerable interest among East Lancashire poultry farmers who visited the exhibition in large numbers to see the practical value of modern appliances in developing poultry farming.

A Travelling Showroom

The Electrical Distribution of Yorkshire, Ltd., is sending out a new travelling showroom motor van, generating its own electricity and carrying a comprehensive range of domestic electrical appliances for display to people in villages which have electricity but to whose population showroom visits are not usually practicable. The van will tour the West Riding and certain parts of the company's area in North Lincolnshire and Cumberland.

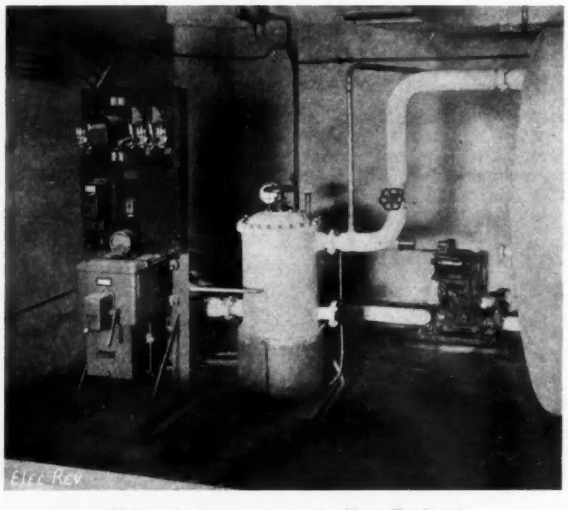
An Electrical Exhibition at Blackpool

An electrical exhibition organised by Blackpool Corporation Electricity Department was recently opened by the Mayor (Ald. G. Whittaker, J.P.), who is also chairman of the Electricity Committee. He said that Blackpool had done its share of propaganda, having during the last five years connected 15,000 new consumers to the mains. The average number of kWh sold per head was now 300. There were still many who used electricity for lighting purposes only, not realising its many advantages for other domestic services. The Electricity Committee would not be satisfied until the average consumption per head of population approached 600 kWh. The aim was

to double the existing output of 40 million kWh per annum within the next eight years. The number of consumers increased from 9,366 in 1925 to 33,366 in 1935; users of radiators and fires from 5,300 to 17,300; cooking apparatus from 426 to 7,826; and water heaters from nil to 2,000. Mr. P. Frampton, for the Electrical Contractors' Association, paid a tribute to Mr. Furness, the borough electrical engineer.

Thermal-storage Heating

The low-voltage hot-water circulator, with electrically operated contactor and hand load control, here illustrated is, we are informed by the manufacturers, Messrs. Bastian & Allen, Ltd., the first thermal-storage plant in New Zealand.



Thermal-storage plant in New Zealand

It has been supplied through the Candy Filter Co. (N.Z.), Ltd., for heating the building of the New Zealand Broadcasting Board, for which a heat storage of 4,200,000 B.th.u. was required, the capacity being 7,000 gal. It was stipulated that its operation should cause no interference with broadcasting. Another broadcasting station which is shortly to be similarly equipped is the B.B.C. regional station at Blaris, Hillsbro', Co. Down; the installation will comprise two 225-kW, 415-V, three-phase electrode boilers with automatic load control. A second unit (400-kW, 400-V with automatic control) has just been dispatched to New Zealand to the order of Messrs. Preece, Cardew & Rider, consulting engineers, for the Wellington City Council electrical showrooms.

Advertisement Correction

Messrs. Rowland's Electrical Accessories, Ltd., ask us to state that the diameter of the 100-W floodlight projector shown on page 29 of the advertisement supplement of our last issue is 8 in., not 8¼ in.

Electric Cooking Progress in France

In the last issue of "B.I.P.," the organ of the Société pour le Developpement des Applications de l'Electricité and the Société pour le Perfectionnement de l'Eclairage, of Paris, the results are given of the inquiries into the progress made in the use of electric cookers and hot plates in France during the year ended with September last. It shows that the number of such appliances has risen from 16,000 in 1931 to 31,000 in 1932, 50,000 in 1933, and to 82,000 in 1934. Last year's increase over the preceding twelve months was equal to just over 60 per cent., while within the past four years the advance has been over 500 per cent. The figures are based on returns received from 210 electricity distribution undertakings.

Orders Recently Booked

The Portuguese broadcasting authorities have decided to erect a 20-kW short-wave broadcaster at Barcarena near Lisbon to establish a broadcasting service of Portuguese culture for the benefit of their colonies, Brazil and Portuguese compatriots living in the United States of America. The transmitter will be manufactured in the New Southgate works of the Standard Telephones & Cables, Ltd. The transmitting station will be furnished with the latest designed directive antennæ, specially erected to serve Portuguese colonies in Africa, India, as well as Brazil, which has many ties with Portugal, and at the same time will give programmes to the United States. The transmitter will be in the building at Barcarena, which houses the medium wave national transmitter already in service.

A Whitsun Cruise

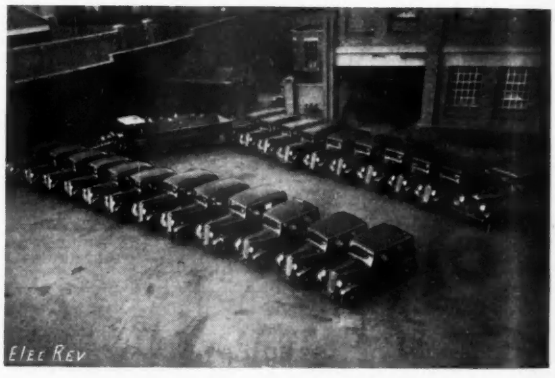
To foster goodwill among their clientele and the electrical and radio trades generally, Gothic Electrical Supplies, Ltd., Birmingham, have organised an eight-day cruise in the P. and O. luxury liner *Viceroy of India*. The accommodation for 600 passengers has been exclusively booked in bulk, and the charges will be very reasonable. The liner will leave Tilbury on June 8th and return to the same port on June 15th.

Ex-Siemens Men

The spirit of good fellowship pervaded the atmosphere of the sixth annual smoking concert of the Association of Ex-Siemens Men which was held on March 22nd at Gatti's Restaurant, London. Mr. J. Snow Huddleston, president of the Association, presided, and a variety programme by well-known artistes was enjoyed by the company. During the evening, a scheme was inaugurated to help those of the members who are out of employment.

The Ellison Fleet

Messrs. George Ellison, Ltd., find it essential always to have reliable cars available for the use of their sales engineers, and they therefore have an arrangement whereby their cars are exchanged for new ones regularly. The cars owned by the company include most of the leading makes, and a new fleet of twenty-one Austin cars ranging from 10 to 18 h.p. was delivered on March 25th. These cars, which represent about one-half of the company's fleet, are shown in the accompanying illustration, together with a new Austin delivery van and a Leyland "Cub" lorry.

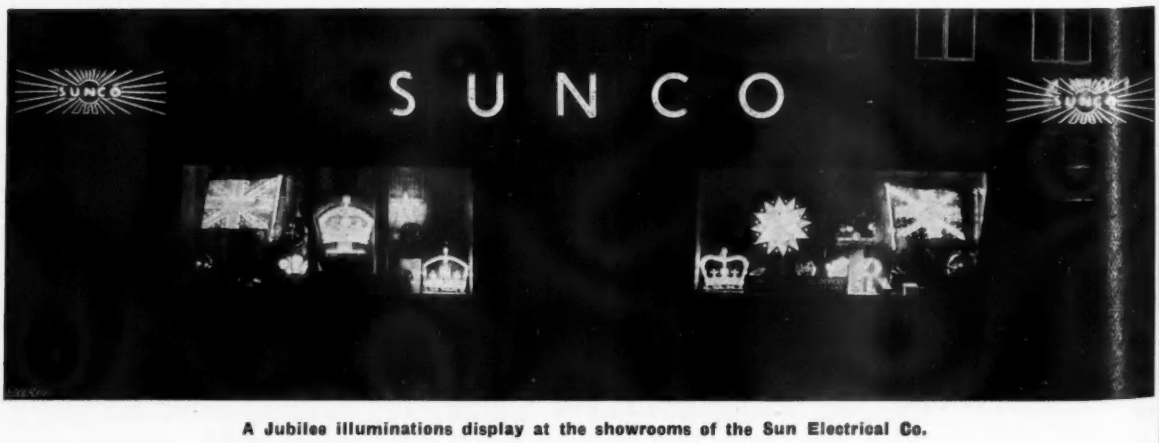


A part of Messrs. George Ellison's fleet of cars

The Jubilee Pageant of England

Philips Industrial is to be responsible for the amplifying arrangements for the Silver Jubilee Pageant of England to be held in May at Langley Park, Slough.

In order that the pageant master shall be heard all over the arena, it will be necessary for a battery of high power radio speakers to be placed at suitable points. At the same time, the speakers will have to be placed so that the instructions are not



A Jubilee illuminations display at the showrooms of the Sun Electrical Co.

heard by the audience. For warning the waiting players in the dressing tents, a microphone will be installed in the control tower. The spoken epilogue will be broadcast to the auditorium by means of a further hidden microphone. Amplifying arrangements for orchestral music and gramophone records are also being provided.

Trade Announcements

Messrs. R. G. McLeod, Ltd., have removed to 30, Gordon Street, W.C.1 (telephone: Museum 1260).

The 20th Century Electrical has removed to 89-90, Newman Street, W.1 (telephone: Museum 8268).

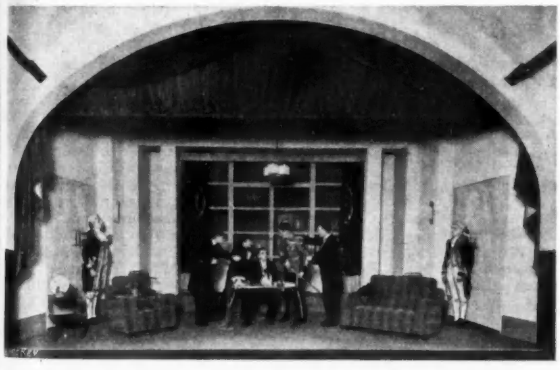
On and after to-day (Friday) the address of Messrs. S. Wolf and Co., Ltd., will be Pioneer Works, Hanger Lane, Ealing, W.5.

Social Events

The annual staff dinner of the North Metropolitan Electric Power Supply Co., was held on Tuesday last at Park Lane Hotel, Lord Ashfield, chairman of the company, presiding. In proposing the toast of "The Northmet Company," Mr. H. G. Gamble said that the company was formed in 1901 and had grown to be one of the largest undertakings in the country supply either directly or indirectly over 250,000 consumers in an area of 600 sq. miles. He referred to the excellent work done by the company in sales and service to consumers; they had a total of thirty showrooms with an efficient sales staff. Mr. C. J. Spencer, in responding, referred to the success last year of Miss G. Young (Hertford undertaking), in the E.D.A. Public Speaking competition, and said that this year Mr. R. H. Fell had gained second place in the competition. Mr. J. M. Donaldson, in proposing the toast of "The Guests," welcomed the presence of so many "old boys," including Mr. W. N. C. Clinch (Brighton), and Mr. E. A. Mills (Hackney). He also welcomed Mr. J. C. Dalton of the County of London Co. They had with them a number of employés who had been with the company for twenty years, to whom long service testimonials were to be presented during the evening. Mr. Dalton responded, and Miss Young proposed the health of Lord Ashfield, who in reply said that he hoped the time was not far distant when the board would be able to show some tangible appreciation of the work of the staff. He then presented the long service testimonials.

At the first annual dinner of the Wigan branch of the E.C.A. held last week, Mr. R. Owen, the borough electrical engineer of Wigan, said the Corporation welcomed the inauguration of the branch. It would do all in its power to further the Association's legitimate objects because it was felt that the standard of electrical work in the past had left a lot to be desired. With collieries closing down and part-time electricians becoming partly unemployed, conditions had become chaotic and he hoped the Association would soon be strong enough to deal with any conditions requiring attention.

The Metropolitan-Vickers Dramatic Society presented "The Queen's Husband," by R. E. Sherwood, at the M.-V. Club



M.-V. Players in a scene from "The Queen's Husband"

Theatre, Stretford, on March 14th, 15th, and 16th. The play was competently acted, while the setting, which was designed by a member of the Society, was excellent. Our picture shows a scene from the play.

On March 22nd the B.T.H. (London) Sports Club held its first annual dinner and dance, with Mr. Easthope (manager at the Willesden works and president of the Club) in the chair. Although the Club has been in existence for a number of years this was the first occasion upon which a joint function has been held. Mr. Worth (entertainment secretary) proposed the toast of "The Firm," to which Mr. Easthope suitably replied. The toast of "The Sports Club" was proposed by Mr. T. Hands (assistant manager, Willesden, and sports club treasurer), and Mr. G. H. Cooke (chief accountant, Willesden, and sports club secretary), in responding, briefly reviewed the Club's activities for the year. Mr. R. F. Brooker proposed the toast of "The Visitors," to which Mr. G. W. Bulmer (Chesterfield) replied. After dinner there were dancing, games and a cabaret entertainment.

New Electricity Showrooms

The chairman of the Saltburn (Yorks) Urban District Council recently opened new electricity showrooms erected by the North-Eastern Electric Supply Co., Ltd. Mr. W. F. T. Pinkney, who presided, said nearly 92 per cent. of the premises in Saltburn were using electricity, and the average price for houses, shops and other premises was 2.48d. per kWh, while for domestic purposes alone the charge was 2.27d.

Cable-laying at Croydon Airport

Cables with a total length of 10,000 yds. are being laid round the boundaries of Croydon Airport to feed the new neon

Cable for the neon lighting system at Croydon Airport

lighting system which is being installed, and our picture shows a consignment from Derby Cables, Ltd., being unloaded.

Prices of Materials

The following prices are only general, and they may vary according to quantities and other circumstances.

CHEMICALS, ETC.	Price, March 27th.	Fortnight's Inc. or Dec.
a Acid, Oxalic ... ... per cwt.	50s.	—
a Ammoniac, Sal ... ... per ton	£40	—
a Ammonia, Muriate (large crystal) ... ,,	£38	—
a Borax ... ... ,,	£17	—
a Copper, Sulphate ... ... ,,	£19 15s.	—
a Potash, Chlorate ... ... per lb.	3¾d. to 4¼d.	—
a ,, Perchlorate ... ... ,,	6d.	—
a Shellac T.N. ... ... per cwt.	£4 18s.	—
a Sulphur Commercial... ... ... per ton	£11	—
a ,, Roll ... ... ,,	£11	—
a Soda Chlorate ... ... per lb.	3¼d. to 3¾d.	—
a ,, Crystals... ... ... per ton	£5 to £5 5s.	—
a Sodium Bichromate, casks ... ... per lb.	4d. nett.	—
METALS, ETC.		
b Aluminium, Ingots ... ... per ton	£100 to £105	—
b ,, Wire ... ... per lb.	1/1 to 1/9	—
b ,, Sheet and Foil... ... ... ,,	1/2 to 2/9	—
p Babbits Metal and Anti-friction Metals—		
Grade I ... ... per ton net	£196	£5 dec.
Grade II ... ... ,,	£135	£3 dec.
Grade III ... ... ,,	£70	£1 dec.
c Brass (rolled metal 2" to 12" basis)... per lb.	6⅞d.	¼d. inc.
c ,, Tubes (solid drawn) ... ... ,,	8¼d. to 9d.	—
c ,, Wire, basis ... ... ,,	7¼d.	¼d. inc.
c Copper Tubes (solid drawn)... ... ,,	9¼d.	—
g ,, Bars (best selected)... ... per ton	£58	—
g ,, Sheet ... ... ,,		
g ,, Rod ... ... ,,		
d ,, (Electrolytic) Bars ... ... ,,	£32 5s.	£2 5s. inc.
d ,, ,, Wire Rods ... ,,	£36 10s.	£2 5s. inc.
d ,, ,, H.C. Wire ... per lb.	6¼d.	⅛d. dec.
f Ebonite Rod ... ... ,,	1/6 to 2/– plus	—
,, Sheet ... ... ,,	1/3 to 1/6 ; 10%	—
n German Silver Wire ... ... ,,	2/5	—
h Gutta-percha, fine ... ... ,,	nom.	—
h India-rubber, Para-fine ... ... ,,	4⅝d.	—
i Iron, Pig (Cleveland No. 3)... ... per ton	62/6	—
i ,, Wire galv. No. 1, P.O. Qual.... ,,	£20	—
g Lead, English Pig ... ... ,,	£14 5s.	£1 15s. inc.
g Mercury ... ... per bot.	£11 10s. to £11 15s.	—
e Mica (in original cases) small ... per)lb.	6d. to 1/–	—
e ,, ,, medium ... ,,	5/– to 10/–	—
e ,, ,, large ... ,,	10/6 to 17/6 & up	—
p Phosphor Bronze, plain castings ... ,,	1/1	—
p ,, ,, drawn bars & rods ,,	10¾d.	—
p ,, ,, rolled strip & sheet ,,	10¾d.	—
p ,, ,, wire ... ... ,,	11¾d.	—
o Platinum ... ... per oz.	£7	—
d Silicium Bronze Wire ... ... per lb.	7¼d.	⅛d. inc.
r Steel, magnet, in bars ... ... ,,	7¾d.	—
g Tin, Block (English)... ... ... per ton	£216 10s.	£1 10s. dec.
n ,, Wire, Nos. 1 to 16 ... ... per lb.	3/8	—

Quotations supplied by :—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta Percha and Telegraph Works Co., Ltd.
g Henry Gardner & Co., Ltd.
h Edward Till & Co.
i Bolling & Lowe.
n P. Ormiston & Sons.
o Johnson Matthey & Co.
p C. Clifford & Sons, Ltd.
r W. F. Dennis & Co.

The above table is published here fortnightly. In alternate issues, in which it does not appear, the latest prices of copper, silicium bronze wire, lead and rubber, up to the time of going to press, are given in our "Business Notes" under the same heading.

A Colour Lighting Display

A colour lighting display is being given by Holophane, Ltd., in its private theatre on April 4th at 3 p.m. There will be a number of spectacular items of colour lighting, dancing and music, showing recent developments. A short lecture on the science of light will be given after the display.

The Manchester Building Trades Exhibition

The fourteenth Building Trades Exhibition, organised by Provincial Exhibitions, Ltd., is to be held in the City Exhibition Hall, Deansgate, Manchester, from April 2nd to 13th.

The E.D.A. Newcastle Carnival

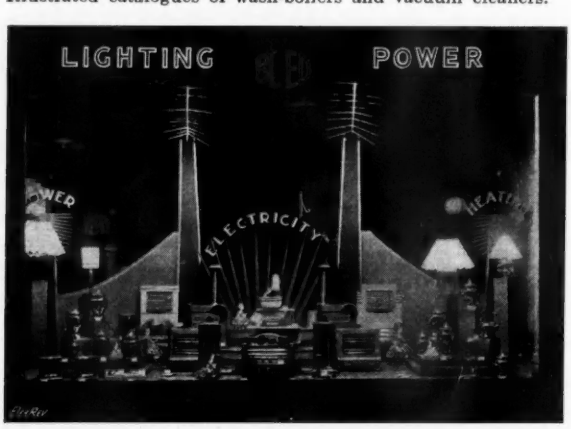
Mr. A. Parkin, Area Officer of the Northern Counties E.D.A. Area Committee, informs us that as a result of the E.D.A. Carnival held in Newcastle in January last a sum of £102 has been paid over to the I.E.E. Benevolent Fund and the E.I.B.A. The organising committee in connection with the Carnival comprised Messrs. W. F. T. Pinkney (chairman), S. G. Pike (North-Eastern Electric Supply Co.), R. H. Davison (A. Reyrolle & Co.), A. W. Bacon (C. A. Parsons & Co., Ltd.), C. Gray (Gray Bros.), and A. Parkin (organising secretary).

New Catalogues and Lists

L. G. Hawkins & Co., Ltd., 30, Drury Lane, W.C.2.—Leaflets on "Supreme" Jubilee electric gifts and a hire-purchase plan for the sale of vacuum cleaners.

Falk, Stadelmann & Co., Ltd., 83, Farringdon Road, E.C.1.—A catalogue of electric shades, bowl fittings and units, a leaflet on the "Cubelite," and list No. 702 on washing machines, wash-boilers, water-heating apparatus, and refrigerators.

Drake & Gorham Wholesale, Ltd., 77, Long Acre, W.C.2.—Illustrated catalogues of wash-boilers and vacuum cleaners.



A display of "British National" and "Universal" electrical appliances by British National Electrics, Ltd., at the Bradford Corporation Electricity showrooms

Wardle Engineering Co., Ltd., Old Trafford, Manchester.—Leaflets describing "Solux" lanterns for use with sodium electric-discharge lanterns.

Ferguson, Pailin, Ltd., Higher Openshaw, Manchester.—New leaflets on circuit-breakers, underground disconnecting switches, single-phase draw-out enclosed units, and single-busbar metal-clad units.

Sloan Electrical Co., Ltd., 8, Golden Lane, E.C.1.—A leaflet on vacuum cleaners.

Rowland's Electrical Accessories, Ltd., Hockley Hill, Birmingham, 18.—A leaflet on a new range of low-priced reflectors for temporary floodlighting.

J. Browett Lindley (1931), Ltd., Coborn Works, Letchworth.—An illustrated catalogue of air and gas compressors.

"Typerlite" Co., 86, Cannon Street, E.C.4.—A catalogue of "Typerlite" lighting fittings.

Cooper-Stewart Engineering Co., Ltd., 136, Long Acre, W.C.2.—A leaflet on an electric sample dryer.

Central Cables & Accessories, Ltd., 138, Lever Street, E.C.1.—A revised price list of t.r.s. cables and flexibles.

Schall & Sons, Ltd., 75, New Cavendish Street, W.1.—Brochures on metal rectifiers for X-ray therapy and a cardiac screening stand.

British Insulated Cables, Ltd., Prescot.—Leaflets on hard-drawn copper conductors for overhead lines and "Thiokol" sheathing for rubber-insulated cables.

Bankruptcy Proceedings

Lloyd Electric Lamp Co., wholesale electrical accessories dealers, 8, Rangoon Street and late of 4, Lloyd's Avenue, E.C.—The receiving order in this matter was made on March 6th on a creditor's petition and the statutory first meeting of creditors was held on March 19th at Carey Street, W.C., Mr. S. W. Hood, Official Receiver, presiding. Joseph Eisner, Joseph Sunshine, Barnett Rome and Toknichi Otaki have attended under the proceedings. Eisner has stated that the business was begun in August last with capital provided by Otaki who paid accounts up to £200. In the following month Rome joined the firm, which had previously consisted of the three other debtors, but found no capital. Owing to heavy trade expenses and lack of capital they held a private meeting of their creditors on February 7th when they offered to pay a composition of 5s. in the £ in two instalments under a guarantee. The offer was not unanimously accepted and proceedings in bankruptcy ensued. On February 15th the landlord distrained. The liabilities are estimated at £1,100 to thirty creditors, while the assets consist of book debts £400. A resolution was passed for the appointment of Mr. G. R. Lowe, River Plate House, Finsbury Circus, E.C., as trustee of the estate.

W. B. Ralphs, 30, Ayresome Street, Middlesbrough, electrical contractor.—The public examination was held at the Court House, Middlesbrough, on March 22nd. Debtor said he commenced trading in August, 1930. He attributed his failure to insufficient profits, and loss on instalments. His deficiency amounted to £228. The examination was adjourned.

J. E. Roberts, trading as Roberts and Goldthorpe, Crosland Moor Mills, Huddersfield, engineer and electrician.—The application for discharge herein was heard at the County Court, Huddersfield, recently. It was reported that the receiving order was made in 1931. The liabilities amounted to £2,229, and there was a deficiency of £1,415. A dividend of 2s. 2d. in the £ had been paid to the creditors. The discharge was granted subject to seven days' suspension.

R. D. Cooper, 5, Cambridge Terrace, Heighington, Durham, wireless engineer, formerly trading at 6, Greenbank Road, Darlington.—The public examination herein was held at the Court House, Stockton-on-Tees, on March 21st. It was stated that the gross liabilities were £1,882, of which £494 was expected to rank for dividend, and there was a deficiency of £343. Debtor attributed his failure to insufficient profits, loss of instalments paid under hire-purchase agreements, and loss by the sale of stock under an execution. The examination was adjourned.

W. S. Handley and **G. Taylor,** trading in co-partnership as Handley and Morgan, wireless dealers, 55, Lower Union Street, Bristol (separate application of George Taylor).—The application for discharge herein was heard at the Guildhall, Bristol, on March 21st. The receiving order was made in 1933. The proofs admitted amounted to £675, and the assets had realised £107. The discharge was granted subject to six months' suspension.

J. A. Bower, lately trading as "The Bradford Electrical Co.," Kent Street, Bradford, manufacturer of electrical equipment. The public examination herein was held at the County Court, Bradford, recently. Debtor said that his liabilities amounted to £167 and his deficiency to £116. He attributed his failure to insufficient turnover, heavy overhead charges, legal costs and bad debts. The hearing was concluded.

E. W. Hills, radio dealer, 20, Havelock Road, Hastings.—Receiving order made March 13 on debtor's own petition. Public examination May 13th at the Town Hall, Hastings.

J. Holder, electrical engineer, 31, Denehurst Gardens, Richmond, Surrey.—Receiving order made March 14th on debtor's own petition.

G. A. Glazebrook (Coventry Electrical and Wireless Supplies), 27A, Victoria Street, Coventry.—Last day for receiving proofs for dividend April 6th. Trustee, Mr. C. J. Band, 9-11, High Street, Coventry, Official Receiver.

C. Mellanby, radio engineer, Penlan Street, Pwllheli.—Last day for receiving proofs for dividend April 6th. Trustee, Mr. I. D. Hooson, St. Peter's Churchyard, The Cross, Chester, Official Receiver.

A. E. Douch and **M. G. Willis** (Douch & Willis), radio and electrical engineers, 109, High Street, Dover.—First and final dividend of 5d. in the £, payable April 1st at 4, Charterhouse Square, E.C.

G. H. Mathew (St. John's Radio), 448, Woodbridge Road, Ipswish.—First and final dividend of 2s. in the £, payable April 4th at 9, Arcade Street, Ipswich.

Private Arrangements

E. W. Willard, electrical and wireless dealer, trading as "Willard's for Wireless," 48, Grove Road, Eastbourne.—A meeting of creditors was held on March 21st at Eastbourne. Mr. A. E. Orbell, accountant and auditors, of 6/7, Old Steine, Brighton, submitted a statement of affairs which showed ranking liabilities of £1,348. The net assets were £595, leaving a deficiency of £1,253. Mr. Orbell reported that in November, 1922, the debtor took an assignment of the lease at the above address, paying £1,000, which included the goodwill of an existing business. There was also stock valued at £2,500, and the whole of the purchase money was paid within seven years. The debtor's commencing capital was £2,300. At the outset the business was that of a cycle and motor-cycle dealer, but in 1924 he commenced a radio department, and eventually got rid of the cycle trade entirely. It was decided that the matter should be dealt with under a deed of assignment with Mr. Orbell as trustee, whilst a committee of the six principal creditors was appointed. It was stated that efforts would be made to sell the business as a going concern.

Company Liquidations

Novo Radio Electric, Ltd.—Particulars of claims by April 20th to the liquidator, Mr. R. E. Smith, 2, Saville Place, Newcastle-upon-Tyne.

Electrical Power Distribution Co., Ltd.—Meeting April 30th at 88, Kingsway, W.C., to receive an account of the winding-up by the liquidators, Messrs. T. Bower & P. M. Rossdale.

British Dry Cell Co., Ltd.—Winding up voluntarily. Liquidator, Mr. C. Wakeling, 8, Serjeants' Inn, Temple, E.C.

Dissolution of Partnership

Express Battery & Ignition Co., electrical engineers and accumulator manufacturers, 2A, Southsea Road, Kingston-on-Thames.—Messrs. W. D. Knight and W. G. Kemp have dissolved partnership. Mr. Kemp will attend to debts and carry on the business.

Receiver Appointed

Mr. H. Watson Humphries, Guildhall Annexe, 23, King Street, E.C.2, has been appointed receiver and manager by the debenture holders of Hart Bros. Electrical Manufacturing Co., Ltd. He contemplates carrying on the business with a view to seeing if the company can be reorganised or reconstructed.

Electricity Supply

Lighting, Domestic, Power

Annfield Plain.—WIRING INSTALLATIONS.—The Urban District Council has received sanction to borrow £1,200 for wiring installations.

Aylesbury.—CHANGE-OVER.—Application has been made by the Town Council for permission to provide out of revenue a sum of £3,750, the estimated cost of changing over the remainder of the town from d.c. to a.c.

Barmby-on-the-Marsh.—CANVASS.—The North Lincolnshire & Howdenshire Electricity Co., Ltd., is arranging to hold a canvass to ascertain the number of prospective consumers.

Barnes.—ELECTRICITY FOR CINEMAS.—The Town Council has reduced the electricity charge for cinemas from 2d. to 1¾d. per kWh.

Baston.—ELECTRICITY SCHEME.—The Parish Council has intimated that it is not prepared to accept the Mid-Lincolnshire Electric Supply Co.'s plans for laying a main in the High Street unless the whole village is supplied.

Belgium.—ELECTRICITY SUPPLY PROGRESS.—In the course of an article by M. Georges de Leener in a recent issue of the *Bulletin* of the Union des Exploitations Electriques en Belgique, it is stated that 97 per cent. of the communes in Belgium are now provided with a supply. The average sale of power to consumers works out at 135 kWh, including large consumers such as shops, cafés, &c.

Bexhill.—SUPPLY TO PEBSHAM.—The Electricity Committee is proceeding with a scheme for supplying electricity to Pebsham at an estimated cost of £1,978.

Boston.—A RURAL LINK.—The Mid-Lincolnshire Electric Supply Co., Ltd., is to link Boston and Spilsby rural districts with a 3,300-V cable.

Bournemouth.—IMPROVED LIGHTING.—The Lighting Committee is considering a scheme for improving the lighting along routes used by trolley-buses at an estimated cost of £4,000, and the Parks Committee has approved a scheme for extending floodlighting at the pleasure gardens at a cost of £1,000.

Brighton.—NEW SUB-STATION.—The increased load in the Saltdean district has made it necessary to replace the sub-station, including a five-panel 150,000-kVA switchboard and two 250-kVA transformers, at a cost of £2,345. A new sub-station is also to be erected at North Portslade.

EQUIPMENT.—To provide an a.c. supply to a building being erected in Western Road a four-panel 150,000-kVA switchboard and transformer plant with automatically operated on-load tap-changing equipment and other apparatus are to be installed in the basement at the cost of £2,710.

ILLUMINATIONS.—The Electricity Committee has approved plans for the summer illuminations. The parish church, Royal Pavilion, Old Steine fountain, and trees at Rottingdean are to be floodlighted at a cost of £1,050.

CHANGE-OVER.—The area enclosed by West Street, Western Road, Preston Street, and King's Road is to be changed over from d.c. to a.c. at an estimated cost of £3,186.

MAINS.—Extensions of mains are to be undertaken at a cost of £2,378.

Bromley.—WORK SCHEMES.—Various mains are to be extended by the Town Council and works carried out at certain sub-stations at an estimated cost of about £12,000.

Buckhaven and Methil.—APPLICATIONS FOR ELECTRICITY.—Following the recent announcement by the Town Council that all the future housing estates in the burgh will be lighted by electricity, about forty applications have been received by Fife Electric Power Co. from tenants in existing housing estates, and the company has commenced laying a cable along Omar Crescent, Buckhaven.

Canada.—LARGER OUTPUT.—Returns show that the principal power stations, which generate 98 per cent. of the output in the country, produced 21,167,682,000 kWh in 1934, representing an increase of 20.59 per cent. on the previous year.

WATER POWER FOR MINING.—The 1934 review of hydro-electric progress, recently issued by the Minister of the Interior at Ottawa, tells of further exploitation of power resources on behalf of the mining industry. In British Columbia the Bridge River Power Co., Ltd., has completed a temporary 4,600-h.p. plant and transmission lines to supply power to the R. Bridge mining district. A 1,000-h.p. unit has been placed in operation on the R. Hurley, a tributary of the Bridge, and numerous smaller projects are in hand. In Manitoba preliminary construction work has been begun at Kanuchuan falls for a 3,800-h.p. development. The Hydro-electric Power Commission of Ontario has just constructed a 1,200-h.p. plant at Rat Rapids on the R. Albany, the power from which is being transmitted to the Pickle Crow and Central Patricia mining districts. Another new installation to assist in the mining of gold has been made on the R. Sturgeon. An additional 5,000-h.p. unit is being installed on the north fork of the R. Klondike, near Dawson. The additional power is expected to be available in June next, and will be used for gold-dredging operations in the R. Klondike and vicinity.

Chard.—EXTENSIONS.—The South Somerset & District Electricity Co. proposes to carry out extensions to Green Knapp and Boozer Pit, Merriott; Foxden Hill, Wadeford; and to Whitelackington.

Chester.—LOAN.—The Electricity Committee has obtained sanction to borrow £30,000 for mains and services.

Clitheroe.—EXTENSION.—The Corporation is to extend the cable between Leogram and Whitewell to Radholme Laund and Middle Lees at a cost of £1,880.

Croydon.—POWER STATION IMPROVEMENTS.—Permission has been granted by the Central Electricity Board for the extension of the power station by the alteration of two 100,000-lb. boilers so as to increase the steam capacity of each boiler to 135,000-140,000 lb. per hour, at a cost of £13,340.

The Electricity Committee is seeking sanction to borrow £75,000 for mains, £40,000 for wiring, £15,000 for public lighting, and £13,340 for plant.

Dorking.—OVERHEAD LINES.—The London and Home Counties J.E.A. is to erect overhead lines at Flint Hill.

Dover.—NEW EQUIPMENT.—Application is to be made for a loan of £3,000 for expenditure estimated at £2,930 in connection with the provision and equipment of new transformer chambers and kiosks.

Eastbourne.—TOWER WAGON.—The Electricity Committee recommends the purchase of a motor tower wagon for street-lighting work.

EXTENSIONS.—Mains extensions costing £895 have been approved.

Eyemouth (Berwickshire).—SUPPLY INAUGURATED.—The electricity supply to the town by the Scottish Southern Electric Supply Co., Ltd., was switched on last week.

Fleetwood. — LIGHTING. — A new scheme of promenade lighting employing 300-W lamps in Holophane lanterns is to be introduced.

Germany. — ELECTRICITY OUTPUT INCREASES.—The production of electricity in Germany, as shown by the returns of 122 representative power stations, increased by nearly 17 per cent. in 1934 over the previous year and almost reached the level of 1929, when 16.9 milliard kWh was generated.

One of the street lighting standards in the new North Beach coast road, Penang, Straits Settlements. G.E.C. "Osira" lamps in "Lewisham" lanterns are used

Glasgow.—HOUSE WIRING.—The Housing Committee has been informed by the Department of Health that it is not prepared to approve of the cost of installing electric lighting as part of the expenditure on which the State grant is calculated, nor to agree to the expenditure being charged against the Repairs Fund. The Committee is approaching the Electricity Committee in the matter.

MAINS EXTENSIONS.—Distributing mains are to be laid at a cost of £4,904.

Headcorn.—INQUIRY.—A public inquiry was held last week into the application of the Weald Electricity Supply Co., Ltd., for permission to carry an overhead line across land for an extension from Knoxbridge to Headcorn and Frittenden. The only opposition was from a landowner, who asked for a supply of electricity gratis in return for a wayleave; an alternative route was chosen eventually.

Hungary.—ELECTRIFICATION PLANS.—M. Bornemissza, the new Hungarian Minister of Commerce, who was general director of the Hungarian Electricity Co., is stated to be considering an extensive programme of electrification, in which foreign concerns would be asked to assist.

Inverness.—POWER STATION IMPROVEMENTS.—The Town Council has approved the reconditioning of the 750-kW steam turbine at the power station, and the installation of a 500-kW convertor, at a total cost of £4,550.

Japan.—POWER PROJECTS.—Our Yokohama Correspondent reports that twenty-five power stations are under construction on twenty different rivers and they have an aggregate capacity of 428,360 kW. It is also announced that five companies in Shikoka are to amalgamate to form a combine with a capital of 100,000,000 yen. Figures giving the capacity of power stations in Japan show that in 1921 it was 783,100 kW; up to 1924 the increase was 21 per cent. per year; between

then and 1928 it dropped to 12 per cent.; in 1930 it was only 1.9 per cent., but revived again in 1932 to 12.4 per cent., when the total capacity reached 3,073,400 kW.

Korea.—ELECTRICAL DEVELOPMENT.—An exploitation of hydro-electric resources in the country is planned by the Electric Power Federation, according to *Reuter's Trade Service* (Tokyo).

London.—ST. PANCRAS.—Application is to be made for the following loans: £4,900 for filtration plant; £442 for new switchgear; and £1,773 for h.v. mains.

INQUIRY.—The Electricity Commissioners are to hold an inquiry at Savoy Court, W.C.2, on May 2nd at 10.30 a.m., with reference to the London and Home Counties Electricity District (Amendment) Order. The Order is designed to enable payment to be made to members of the London and Home Counties Joint Electricity Authority out of its revenues of reasonable compensation for the loss of remunerative time.

Long Riston.—SUPPLY INAUGURATED.—An electricity supply for the village was inaugurated on March 12th.

Manchester.—NEW PLANT.—Due to expansion in the Wythenshawe area, it has been found necessary to install 33-kV switchgear and transformers in the Benchill sub-station, and application has been made for sanction to a loan of £20,000 for the purpose.

ALL-IN TARIFF.—The all-in tariff will be available in future to all domestic consumers who have installed either an approved electric water-heater of not less than 750-W capacity or apparatus, other than lighting, of a minimum capacity of 2 kW.

Minehead.—INQUIRY.—An inquiry was held at Minehead last week in connection with the proposed erection of overhead supply cables in Alcombe Combe by the Minehead Electric Supply Co., Ltd. Objection was made by the Urban District Council and the Somerset Rural Community Council, who claimed that the scheme would spoil the common. On behalf of the company, it was stated that nineteen poles would be erected in the Combe. The cost was estimated at £219, but if the supply line were carried underground it would be £430. An annual revenue of £73 was expected.

Monmouth.—OVERHEAD LINE.—The Town Council has consented to an application by the Monmouth Electricity Co. for permission to erect an overhead line at Osbaston.

Mynyddislwyn (Mon).—LOWER CHARGE.—The Urban District Council has reduced the charge for heating and cooking from 1½d. to 1d. per kWh as from April 1st.

North-East Coast.—REVISED TARIFF.—The North-Eastern Electric Supply Co., Ltd., has announced a new scale of charges for electricity for Northumberland, Durham and North Yorkshire. A domestic tariff for electricity used for all purposes provides that, in the case of four-roomed houses, the charges will be: Winter quarters, 4½d. per kWh for the first 32, 3½d. for the next 26, and 1d. for the following 500 kWh; summer quarters, 4½d. per kWh for the first 16, 3½d. for the next 13, and 1d. for the following 250 kWh. Corresponding charges for varying consumptions are fixed for larger houses up to fifteen rooms. The heating and cooking tariff (not domestic) is 2½d. per kWh for the first 240 kWh and 1½d. for the following 240 kWh in the winter, while in the summer the first 60 kWh will be charged at 2½d. and the following 60 at 1½d. The water-heating tariff (restricted to energy supplied to thermostatically controlled storage heaters) is 0.7d. per kWh.

Padiham (Lancs).—LOWER CHARGES.—The Council is recommended to reduce the all-in charge for electricity from ¾d. per kWh to ½d.

Pilling (Lancs).—If the residents can guarantee Preston Corporation an annual revenue of £900 the village will be provided with a supply of electricity, possibly before next winter. A canvass is being made.

Richmond (Surrey).—LOWER CHARGES.—The Richmond Electric Light & Power Co., Ltd., has reduced the standing charge of 6s. 3d. per quarter per 100 W installed under the business two-part tariff by 1s. 3d., and has introduced a new group under the domestic two-part tariff of 0-800 sq. ft. with a quarterly charge of 10s. instead of 12s. 6d. The slot-meter charge for lighting has been reduced from 6d. to 5½d. per kWh, and, where the wiring has been installed by the company, from 7d. to 6½d.

Romford.—STREET LIGHTING.—"Osira" street lighting has recently been installed by the County of London Electric Supply Co., Ltd., in many of the principal thoroughfares.

South Africa.—LICHTENBURG SCHEME APPROVED.—The electricity scheme for Lichtenburg, Transvaal, estimated to cost £10,000, has been approved by the Provincial Administrator. Mr. G. A. Adendorff, consulting engineer, Cape Town, has been asked to prepare specifications to enable tenders to be invited.

Southend-on-Sea.—MAINS EXTENSIONS.—The Town Council has applied for a loan of £10,125 for mains extensions in the added supply area.

Stanion.—SUPPLY ARRANGEMENTS.—Premises at Stanion have been wired for electricity, and are about to be connected to Kettering electricity department's lines.

Stokesley (Yorkshire).—LOWER CHARGES.—The North-Eastern Electric Supply Co., Ltd., has informed the Rural District Council of its intention to reduce electricity charges from 6d. to 5½d. per kWh.

Sussex.—JOINT ACTION.—The Midhurst Rural District Council is joining with eight other Councils in the county in a proposal to engage an expert, at a cost of 250 gn., to inquire into the accounts of the Mid-Southern Utility Co., Ltd., with a view to ascertaining whether there is a case for a reduction in the price of electricity.

Wallasey.—HIRE OF ELECTRICAL APPLIANCES.—The Electricity Committee has agreed that the maximum period for the hire-purchase of electric cookers shall be extended from four years to six years, and that the cost of installations and wiring (maximum length of 30 ft.) shall be included in the terms of the agreement. Electric water-heaters are to be let out on hire at a rental of 5s. per quarter, including fitting and wiring.

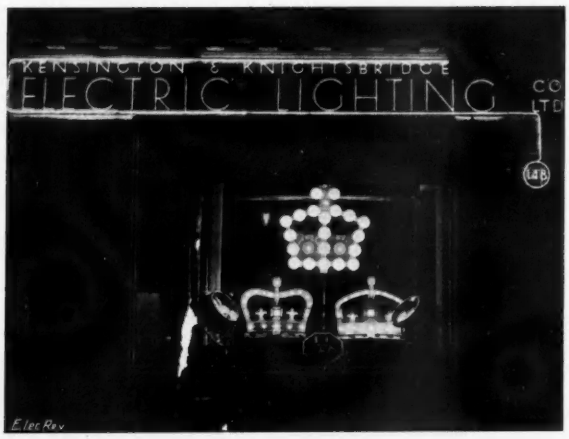
AREA EXTENSION.—The Electricity Committee has obtained sanction to borrow £8,081 for the purchase of that part of the Birkenhead undertaking which is in the Saughill Massie area.

Wick.—DEVELOPMENT.—The Electricity Commissioners have authorised the Town Council to borrow £7,500 for mains and services in connection with the electricity undertaking. The Commissioners are also to send a chartered accountant to investigate the advisability of authorising a further loan to complete the sum of £11,000 originally asked for by the Council. Meanwhile, the Thurso & District Electric Supply Co., Ltd., is negotiating with the Council with a view to a bulk supply.

Plans for the Jubilee

ARRANGEMENTS continue to be made all over the country for celebrating the Royal Jubilee with illuminations, and the following additional plans have been reported to us:—

A kW charge of 2s. 6d. is to be made for electricity used for illuminations at Leeds, while the Bedfordshire, Cambridgeshire and Huntingdonshire Electricity Co. is to supply electricity at ¾d. per kWh, and Witney is to be supplied at 2d. per kWh for special illuminations.



A Jubilee display at the showrooms of the Kensington and Knightsbridge Electric Lighting Co., Ltd.

The Stoke Newington Electricity Committee has recommended that where temporary decorative lighting is installed and connected to a shop circuit an allowance of 10 per cent. shall be given on the June quarter account. Where the supply is taken under the maximum demand scale the demand indicator shall be cut out of circuit while the temporary illuminations are in use, the electricity then being charged at ¾d. per kWh.

The Halifax Electricity Committee has agreed to supply electricity for exterior illuminations for a fortnight at ½d. per kWh, while the South Cumberland Electricity Co. is to provide energy without charge for celebrations; in the Walton and Weybridge Council's area 1d. per kWh is to be charged.

Cardiff Electricity Department is to supply energy without charge for all external illuminations during Jubilee Week.

Walton and Weybridge Electricity Department is to spend up to £100 on illuminations and decorations. Street illuminations are to be carried out at Langcliffe, and the Settle and District Electricity Co. has been asked to supply the electricity required gratis. Illuminations are also proposed at Matlock, and the west front of Peterborough Cathedral is to be floodlighted.

Illuminations at Croydon are promised by the electrical engineer "on a scale which will give the town distinction," and the floodlighting of prominent buildings is recommended at Guildford. It is proposed to floodlight St. Martin's Church, Wareham, and the guildhall, cathedral and war memorial at Exeter.

Floodlighting and illuminations have also been sanctioned by the Dukinfield Jubilee Committee and the Heckmondwike Electricity Committee.

Traction

Australia.—CABLE TRAMWAYS.—Mr. A. Cameron, chairman of the Melbourne Tramways Board, states that it is the intention of the Board to convert the South Melbourne tramway cable route to electric operation when the opportunity presents itself. Omnibuses will probably be substituted for the cable tramway on the Port Melbourne route, which is unprofitable. No decision has yet been made as to the form of transport that will be substituted on the Northcote route.

Dover.—FUTURE OF TRANSPORT UNDERTAKING.—A committee of the Town Council has recommended the Council to enter into a twenty-one-year agreement with the East Kent Road Car Co., Ltd., to take over the town's transport arrangements. The company would be asked to contribute £3,000 towards the reinstatement of the roads and to pay the Corporation 75 per cent. of the surplus revenue (about £2,000), the Corporation to make good any deficiencies. The company would also be required to compensate the tramway employés who would be displaced and to retain the halfpenny fares for children.

Germany.—DIESEL-ELECTRIC BUSES.—*Verkehrstechnik* reports that the Berlin Verkehrs Gesellschaft, which operates the motor buses in the German capital, is experimenting with two Diesel-electric 75-seater six-wheel buses. The vehicles are fitted with Bussing 110-120-h.p. oil engines, the electrical equipment in one having been supplied by the Allgemeine Electricitäts Gesellschaft (A.E.G.) and in the other by Siemens-Schuckert.

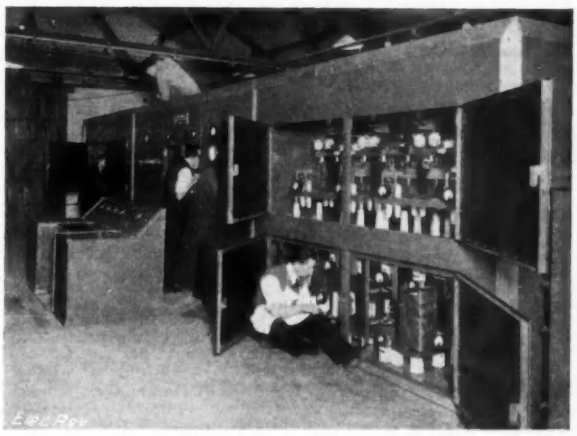
South Africa.—RAND RAILWAY ELECTRIFICATION.—The Government has decided to electrify the Rand railway at a cost of £1,000,000. Work may be commenced this year.

South Shields.—TRAM-TRACK RENEWAL.—The Town Council is to spend £4,000 on relaying the tram track in Fowler Street.

Communications

Great Britain.—AID TO DIALLING.—The Post Office has produced a ring about half an inch wide on which are stamped telephone dial letters and numbers about three times as large as usual. This fits over the ordinary dial, and is intended to aid subscribers with defective vision.

NORTH-EASTERN DISTRICT REPORT.—In their report for 1934, Mr. C. A. Taylor, superintending engineer of the North-Eastern District, and Mr. F. G. C. Baldwin of the Northern District, state that the rapid decline in telegraph traffic during 1929-32 has been arrested. With regard to telephones, the number of new installations was 7,594, and the net increase was 3,841 (7.1 per cent.). During the year sixty-five new call offices were opened, bringing the total to 1,880, and nine new exchanges (seven of the automatic type) were put into operation. New automatic exchanges are being provided to serve West Auckland, Gilling West, Stokesley, and Corringham, and the replacement of eight manual exchanges has been authorised. Cables from Leeds to Harrogate and Wakefield to Castleford have been inaugurated during the year, and a line between Lincoln and Skegness is under construction, while new switchboards were installed at Middlesbrough and York.



Transmitting equipment for the new broadcasting station to be erected near Jerusalem by the Government of Palestine being prepared for final tests at the Marconi Works, Chelmsford. The three main panels of the transmitter are shown, with the control desk on the left. The power will be 20 kW unmodulated aerial energy

Irish Free State.—RADIO LICENCES.—The number of radio licences is increasing steadily. At the end of last year 59,952 were in force. In June last the number was 52,901.

Liverpool.—WIRELESS BEACON FOR AERODROME.—Speke Aerodrome is to be fitted with the latest type of wireless approach beacon, the installation of which will be carried out by the Marconi Co. The installation will comprise a main approach beacon of the aural type and two " marker " beacons to indicate when the pilot is flying on the correct approach line. They will be remotely controlled from the aerodrome. The main beacon is arranged so that it can be used as a telephone or telegraph transmitter in case of emergency.

South Africa.—CONTROL OF THE BROADCASTING SERVICES.—An Exchange Telegraph message received from Cape Town states that the Government of South Africa is adopting the proposals put forward by Sir John Reith, and is placing the South African broadcasting service in the ownership of a public body. It has decided not to renew the African Broadcasting Co.'s licences when they expire in 1937, but to form a new organisation to carry on the work, for which purpose a Bill will be introduced during the next session.

The Moscow Underground Railway

THE first line of the Moscow Underground has now been completed, except for some minor details. This line is a little over 11 km. long and extends from the Sokolniki Park to Crimea Square, connecting Theatre Square in the heart of the hotel and theatre district with two of the most populous suburbs. There are in all eleven stations on this route. The first test train made a successful journey along the entire track on February 4th. The second line, connecting four railway stations and Izmailova Park, is at the present time about half completed.

Attention has been paid to the ventilation and the system of lighting the stations, fresh air being conducted and stale air drawn off by means of tunnels. The illumination is entirely by floodlighting. According to the *Monthly Review* of the Moscow Narodny Bank, the carriages, which are 18.8 metres long and built entirely of metal, have upholstered seats, and the four double doors open and close automatically. A system of ventilation has been installed for the trains themselves.

The entrance to the Sokolniki station of the Moscow " Metro."

The underground railway project was first proposed by Russian engineers in 1902, but was abandoned as impracticable. The scheme was revived in 1931, when Moscow's rapidly growing population imposed impossible burdens upon the existing transport systems. In June, 1931, the plans were approved for an underground railway, and in November of the same year the first hundred metres of open tunnel was built. At first construction progressed slowly as coal miners were working in the tunnelling under the supervision of Russian engineers without previous experience of such work. It soon became apparent that not only was Moscow underlaid with a number of underground rivers and a network of mediæval tunnels and caves, but that the subsoil was so soft that tunnels collapsed as rapidly as they were built. In 1932, after 6,000 workers had unsuccessfully attempted a number of tunnels, the most experienced experts advised that the project was impossible and should be abandoned.

However, first of all, every known method was applied including the British shield system, the American " flying arch," the French caisson system, the Belgian double-passage and artificial freezing. All these methods were used with varying success, but real progress only became possible after the discovery late in 1932 of a method of treating the subsoil with chemicals which held the tunnel walls together until concrete linings could be completed. The labour army rose from 6,000 to 67,000, including about 5,000 engineers and technicians. Engineers soon discovered that miners did not work as well as untrained labour, and about eighty per cent. of the present staff had no previous experience in underground work. Labour was strengthened by the enlistment of experienced underground workers from Great Britain, the United States, Germany and France.

Contract Information

When "Contracts Open" are advertised in our "Official Notice" pages the date of the "Electrical Review" containing the advertisement is given in parentheses below

Contracts Open

Aldershot.—April 2nd. Electricity Department. E.h.p. and l.p. cable, and prepayment meters for the year ending March 31st, 1936. (March 22nd.)

Australia.—MELBOURNE.—State Electricity Commission. April 29th. Porcelain insulators. (A.Y. 12966.)*
Posts and Telegraphs Department. May 14th. V.i.r. l.c. cable. (A.Y. 12965.)*
City Council. May 8th. Ring main switchgear. (A.Y. 12976.)*

Bath.—Electricity Department. Cables, joint boxes, fuse boxes and meters. (March 22nd.)

Bedford.—April 1st. Electricity Department. Installation work on consumers' premises at scheduled prices. Specifications, &c., from, and tenders to, the Borough electrical engineer, Electricity Works, Prebend Street.
April 24th. Public Assistance Committee. Electric lighting at the Biggleswade Institution. Specifications from the County surveyor, Shire Hall; tenders to the clerk of the County Council.

Bexhill.—March 30th. Electricity Department. Collection, conversion and re-installation of d.c. wireless apparatus. (March 22nd.)

Blackpool.—April 23rd. Electricity Department. 1,750-kW motor convertor. (See this issue.)

Bridlington.—April 3rd. Electricity Department. L.p. cables for the year ending March 31st, 1936. (See this issue.)

Brighton.—April 3rd. Education Committee. Electric lighting at the Warren Farm schools. Specifications, &c., from T. Simpson & Son, surveyors, 16, Ship Street (deposit £1).
April 6th. Waterworks Department. Electric lighting at Goldstone pumping station, four cottages and one house. Specifications, &c., from the waterworks engineer, 12, Bond Street; tenders to the town clerk.

Bristol.—April 10th. Electricity Department. E.h.p. switchgear, l.p. switchgear, 6.6 kV and 11 kV transformers. (See this issue.)

Coventry.—April 18th. Education Authority. Machinery, tools, apparatus and equipment for new Technical Colloge. (March 22nd.)
April 15th. Electricity Committee. Demolition of two steel cooling towers. (See this issue.)

Dundee.—April 4th. Electricity Department. General engineering stores for one year. Specifications, &c., from D. H. Bishop, general manager and engineer, Dudhope Crescent Road; tenders to town clerk.

Durham.—April 1st. County Mental Hospital Visiting Committee. Deep well, borehole turbine pump with electric motor, and sinking borehole. (March 15th.)

Ealing.—March 29th. Electricity Department. Meters. (March 22nd.)
April 5th. Electricity Department. L.p. cable. (See this issue.)

Edinburgh.—April 3rd. Corporation. Electric passenger lift at Education Offices. Specifications, &c., from the city architect; tenders to the town clerk.
April 8th. Gas Department. Electro-detarring vessels and h.p. generating sets, switchgear, cable, &c., for the Granton gasworks. Specifications, &c., from the engineer and manager, Gas Department, 15, Calton Hill; tenders to the town clerk.

Erith.—April 10th. U.D.C. Electric lamps during twelve months ending March 31st, 1936. (See this issue.)

Gloucester.—March 30th. Electricity Department. Rotating standard meter test bench. (March 22nd.)

Halifax.—April 8th. Housing Committee. Various works, including electrical, at houses on the Pye West (ninety-eight) and the Ling Bob (twenty-eight) housing schemes. Specifications, &c., from the borough engineer, Crossley Street (deposit £2 2s.); tenders to the town clerk.

Heckmondwike.—April 5th. Electricity Department. Plant and cables, meters, &c., in connection with the proposed change-over. (March 15th.)

High Wycombe.—April 3rd. R.D.C. For the Stokenchurch, Radnage and Bledlow Ridge water supply (contract No. 4): Centrifugal borehole, horizontal turbine, and booster pumps with electric motors, booster tanks with electrical control equipment, switchboards, gauges, &c. Particulars from the water engineer, Council's Offices, 17, High Street (deposit £2 2s.).

King's Lynn.—April 6th. Electricity Department. Supply and laying of 11,000-V cable. (March 22nd.)

Lanark.—County Council. Various works, including electrical, at sixty houses at Blantyre and Bellshill. Particulars from P. S. Smith, County housing and town planning engineer, Hamilton, by April 2nd.

Leeds.—April 10th. Transport Committee. 6,600-V switchgear for a traction sub-station. (See this issue.)

Leyton.—April 8th. Corporation. Two 1,000-kVA and two 500-kVA transformer kiosk sub-stations. (See this issue.)

London.—ST. PANCRAS.—April 4th. Electricity Department. One 100-b.h.p. oil-driven engine and d.c. generator. (March 15th.)
FULHAM.—April 17th. Borough Council. Two (or three) electrically operated luffing, slewing and travelling portal jib cranes (Section "N"). Specifications, &c., from borough treasurer, Town Hall (deposit £5 5s.); tenders to the town clerk.
H.M. OFFICE OF WORKS.—April 4th. Steel conduit tubes and fittings. (March 22nd.)
LONDON & HOME COUNTIES J.E.A.—April 8th. Annual supply of general electrical accessories. (March 22nd.)

Manchester.—April 11th. Electricity Committee. A.c. motors, time switches, transformers, kettles and meters for twelve months. (See this issue.)
April 17th. Static transformers for sub-stations. (See this issue.)
April 8th. Two neutral earthing switch equipments and resistor at Benchill sub-station and l.p. pipework at Stuart Street power station. (See this issue.)

Morecambe and Heysham.—April 11th. Corporation. Medium-pressure switchboards and 400-kVA transformer. (See this issue.)

New Zealand.—DUNEDIN.—Corporation Tramways. April 26th. Feeder cable. (A.Y. 12964.)*
WELLINGTON.—Public Works Tenders Board. June 25th. Three 1,500-kVA single-phase transformers. (A.Y. 12963.)*
Post and Telegraph Department. May 2nd. Telephones. (A.Y. 12978.)*
Public Works Department. June 18th. Oil circuit-breakers. (A.Y. 12979.)*

Northern Ireland.—OMAGH.—April 16th. Committee of Management of Tyrone and Fermanagh Mental Hospital. Various works, including electrical, at the Omagh Mental Hospital. Specifications, &c., from V. H. Murnaghan, Lisonelly House; tenders to the clerk of the Hospital.

Peterborough.—April 2nd. Education Committee. Electric lighting at the Folbridge Council school. Particulars from S. Dodson & Son, architects, Museum Buildings, Priestgate, by March 25th (deposit £2 2s.).

Portsmouth.—April 17th. City Council. Electrical work at St. Mary's Hospital, Milton. Specifications, &c., from the city engineer, Guildhall (deposit £1 1s.); tenders to the town clerk.

Salford.—April 10th. Electricity Department. Electrical installation for 128 flats. Particulars from the city electrical engineer, Electricity Department, Frederick Road.

Saltcoats (AYRSHIRE).—April 4th. Town Council. Electric lighting at fifty houses. Schedules from H. Thomson & Sons, architects and surveyors, 60, Hamilton Street; offers to joint town clerks.

South Africa.—JOHANNESBURG.—April 13th. Municipality. 200 steel street-lighting poles. (G.Y. 14960.)* Electric street-lighting standards complete with lamps. (G.Y. 14961.)*
April 26th. Magneto telephone switchboards. (A.Y. 12975.)*

Stoke-on-Trent.—April 3rd. N.W. Midlands J.E.A. Meters. (March 15th.)
April 10th. Electrical Engineer's Department. Overhead transmission lines. (See this issue.)

Straits Settlements.—SINGAPORE.—April 23rd. Municipality. Electrically driven centrifugal pumping plant. (G.Y. 14958.)*

Swansea.—April 2nd. Libraries Committee. Electric lighting and heating at the New Library, Oystermouth. Particulars from the borough architect, Guildhall (deposit £2); tenders to the town clerk.

Wakefield.—April 15th. West Riding Public Assistance Committee. Various works, including electrical, at the new casual wards, Tadcaster. Specifications, &c., from the West Riding architect, County Hall; tenders to the clerk of the County Council.

Warrington.—April 10th. County Mental Hospital Visiting Committee. Electric generator plant for the hospital, Winwick. Particulars, &c., from the clerk and steward; tenders to the chairman of the Visiting Committee.
April 15th. Electricity Department. Transformer. (See this issue.)

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* Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Contracts Closed

Australia.—COMMONWEALTH.—P.M.G.'s Department. Single channel carrier telephone equipment (£2,588) and transformers (£907).—British General Electric Co., Ltd.
NEW SOUTH WALES.—Sydney Municipal Council. Cable (£5,751.)—Enfield Cable Works (Aust.), Ltd.
VICTORIA.—Melbourne City Council. Cable.—British Insulated Cables, Ltd. (£119); Liverpool Electric Cable Co. (£117); British General Electric Co., Ltd. (£441).

Bexhill.—Electricity Committee. Accepted. Switch and fuse gear (£176).—W. Lucy & Co., Ltd.

Brighton.—Corporation. Accepted. Control switchgear and panel instruments (£2,020) and alternator protection gear (£148).—Metropolitan-Vickers Electrical Co., Ltd. Lighting scheme for the sea front (£3,386).—Ionlite, Ltd.

Dundee.—Public Health Committee. Accepted. Electric lighting at additions and alterations to the Mental hospital, Westgreen (£192).—D. J. MacDonald, Ltd.

Eastbourne.—Corporation. Accepted. L.p. joint boxes and h.p. pole boxes.—Callender's Cable & Construction Co., Ltd. H.p. joint boxes.—W. T. Henley's Telegraph Works Co., Ltd. L.p. terminal boxes, cut-outs and fuses.—W. Lucy & Co., Ltd. Cookers.—Simplex Electric Co., Ltd. Kettles.—Bulpitt & Sons Ltd.

Edmonton.—Middlesex C.C. Accepted. Wireless installation at North Middlesex County Hospital (£848).—Tannoy Products, Ltd.

Exeter.—Electricity Committee. Accepted. 1,500 service cut-outs (£274).—Callender's Cable & Construction Co., Ltd., 144 link disconnecting boxes (£766).—Pirelli-General Cable Works, Ltd.

Glasgow.—Libraries Committee. Accepted. Electric wiring at Anderston District library (£190).—Johnston Park & Co., Ltd.

Markets Committee. Accepted. Electrical installations at premises in Walls Street and Albion Street (£706).—Johnston Park & Co., Ltd.

Transport Committee. Accepted. Cables (£2,000).—Craigpark Electric Cable Co., Ltd.

Guildford.—Education Committee. Accepted. Electric lighting installation at new Senior Boys' school, Stoughton (£314).—Bowden & Higlett, Ltd.

Kettering.—U.D.C. Accepted. Ordinary type and two-part tariff prepayment meters.—Venner Time Switches, Ltd.; Ferranti, Ltd.

London.—EALING.—Electricity Committee. Recommended. Transformer (£519).—C. A. Parsons & Co., Ltd.

WESTMINSTER. — Highways Committee. Recommended. "Electricar" motive unit and carrier equipped with gulley emptying apparatus (£2,034).—Electricars, Ltd.

HACKNEY.—Works and Open Spaces Committee. Recommended. Three electric vehicles.—Electricars, Ltd.

STEPNEY.—Electricity Supply Committee. Recommended. Private automatic telephone exchange and sets (£254).—Standard Telephones & Cables, Ltd. Cables during twelve months ending March 31st, 1936 (£4,271).—W. T. Henley's Telegraph Works Co., Ltd.

HAMMERSMITH.—Electricity Committee. Recommended. For twelve months from April 1st, 1935. Insulating compound.—Dussek Bitumen & Taroleum, Ltd. Electrical goods.—W. Maxwell & Co., Ltd. Cables.—Hackbridge Cable Co., Ltd. Joint boxes, ironclad cutouts, &c.—W. Lucy & Co., Ltd. Insulated wires.—Mersey Cable Works, Ltd. Meters.—Aron Electricity Meter, Ltd.; British Sangamo Co., Ltd. Locks for prepayment meters.—Venner Time Switches, Ltd. Neon sign installation at the electricity showrooms (£194).—Ionlite, Ltd.

Southend-on-Sea.—Town Council. Accepted. Electrical installation at the health centre, Victoria Hospital (£500).—W. H. Squier.

West Hartlepool.—Town Council. Accepted. Sub-station—Electric Construction Co., Ltd.

Forthcoming Events

Electrical Industries Benevolent Association (*South Coast Section*).—Friday, March 29th. Grand Hotel, Brighton. 8.30 p.m. Dance.

Electrical Power Engineers' Association (*Birmingham and District Section*).—Friday, March 29th. Edgbaston Assembly Rooms, Birmingham. 7 for 7.30 p.m. Annual dinner-dance. (*London Western Section*).—Saturday, March 30th. St. Ermin's Hotel, S.W.1. 6.30 for 7 p.m. Annual dinner.

Royal Institution.—Friday, March 29th. Institution, London. 9 p.m. "The Neutron and Radio-Active Transformations." Lord Rutherford. Saturday, March 30th. Institution, London. 3 p.m. "Electromagnetic Radiations." Lord Rutherford.

Institution of Electrical Engineers.—Monday, April 1st. Institution, London. 7 p.m. Informal meeting. Discussion on "Change-overs." To be opened by Messrs. H. Brierley and A. F. W. Richards. Thursday, April 4th. Institution, London. 6 p.m. Faraday Lecture. "Electricity in the Life of To-day." Prof. E. W. Marchant. (*Western Centre*).—Friday, March 29th. Merchant Venturers' Technical College, Bristol. 7 p.m. Joint meeting with the Western Branch of the Institution of Mechanical Engineers. "Some Factors in Maintenance Engineering." Mr. A. J. Bowron. (*South Midland Centre*).—Monday, April 1st. James Watt Memorial Institute, Birmingham. 7 p.m. Discussion on "The Future Development of Thermionic Receiving Valves." To be opened by Mr. T. E. Goldup. (*North-Western Centre*).—Tuesday, April 2nd. Engineers' Club, Manchester. 7.15 p.m. Annual general meeting. "The Droitwich Broadcasting Station." Messrs. N. Ashbridge, H. Bishop and B. N. McLarty. (*Wireless Section*).—Wednesday, April 3rd. Institution, London. 6 p.m. "The Non-Linear Theory of the Maintenance of Oscillations." Dr. P. le Corbeiller. (*Meter and Instrument Section*).—Friday, April 5th. Institution, London. 7 p.m. Two papers by Mr. H. M. Barlow. (*North-Eastern Students' Section*).—Friday, April 5th. Armstrong College, Newcastle-upon-Tyne. 7.15 p.m. Annual general meeting. "Short Paper Night."

Association of Mining Electrical Engineers.—Tuesday, April 2nd. Junior Institution of Engineers, S.W.1. 6.30 p.m. "Borehole Pumps for Disused Mine Drainage." Mr. C. Atherton Atchley. (*West Wales Branch*).—Saturday, April 6th. Y.M.C.A. Swansea. Annual dinner.

Institution of Civil Engineers.—Tuesday, April 2nd. Institution, London. 6 p.m. Papers on "Hydro-Electric Schemes." Messrs. F. W. Furkert and M. G. Platts.

Electrical Contractors' Association (*Manchester Branch*).—Thursday, April 4th. Midland Hotel, Manchester. Annual dinner.

Physical Society.—Friday, April 5th. Imperial College of Science and Technology, S.W.7. 5 p.m. Short papers.

Makers' Names Wanted

LISTER daylight lamp.

Notes

I.M.E.A. Local Centres

We refer to the setting up of local centres of the I.M.E.A to cope with increasing problems of electricity supply undertakings, in a leaderette to-day. The following centres have been formed and are now functioning:—Mid-East England; Scottish; and North-East England. Recently the I.M.E.A. Council approved the formation of a centre for the South-East and East England area, and the first annual meeting of this centre was held on February 25th, when the following gentlemen were elected by ballot to serve on the executive committee:—Messrs. W. E. Affleck (Guildford), W. N. C. Clinch (Brighton), W. R. Elliott (East Ham), H. Hall (Gillingham), S. E. Jackson (Barnes), H. A. Nevill (Peterborough), V. A. Pask (Norwich), F. N. Rendell-Baker (Croydon), and J. W. J. Townley (West Ham). Mr. J. W. J. Townley was elected chairman of the centre for the ensuing year and Mr. H. A. Nevill vice-chairman. Mr. J. W. Simpson, the secretary of the Association, will act temporarily as secretary and treasurer of the centre, and its offices are at the I.M.E.A. headquarters, Australia House, Strand, London, W.C.2.

A Novel Traffic-warning Device

To warn the driver of a lorry that his vehicle is too high to pass into an underground roadway, at the gates of Paris, a photoelectric system has been installed. Two projectors shine into two photoelectric cells above the street, and when a lorry cuts the two beams in the proper order, *i.e.*, when moving towards the passage, a warning is sounded by a loud speaker, "Lorry too high; go around the tunnel" (in French, of course), and, at the same time, a warning lamp shines at the entrance to the passage. The auxiliary relays are fed by a ferro-nickel storage battery at 12 V, 35 Ah, which is recharged by a selenium rectifier during the periods of rest. The voice is reproduced from a section of talking film in a Western Electric sound machine of the cinema type, driven by a small asynchronous motor. Should the system be out of order a warning signal is sounded in the nearest office of the street-lighting department.

A Wire Gauge Chart

We have received from Messrs. Henry Wiggin & Co., Ltd., a useful chart for electrical resistance wires and alloys. This is in the form of two discs, and on one side data is given of the weight and current required to maintain a stated rise of temperature for any particular gauge of "Brightray," "Glowray," and "Dullray" wires, and the gauge and length of wire required for appliances, such as fires, irons, kettles and immersion heaters. Corresponding data for "Ferry," nickel and "Mangonic," and "Brightray" and "Glowray" tapes is given on the reverse side.

A Glass Convention

The British glass industry is holding its fourth convention at Folkestone from May 16th to 18th. Mr. Geoffrey L. Pilkington will preside and there will be addresses and discussions by well-known authorities on such questions as design in the glass industry, uniformity and quality of products, planning, and the commercial importance of furnace design. Besides official luncheons in the Grand Hotel, Folkestone, on May 16th and 17th, there will be many social events.

The Southampton Docks

The 1935 edition of the Southampton Docks Handbook, published by the Southern Railway, like previous editions, contains detailed particulars of the accommodation and equipment at these docks, including interesting details of the electrical equipment which includes electric trucks and tractors and electric cranes. Other information of value are scales of rates and charges for various commodities, and regulations and conditions upon which services and accommodation are provided.

The International Electrotechnical Commission

At the invitation of the Netherlands and Belgian Electrotechnical Committees, the International Electrotechnical Commission is organising plenary meetings at The Hague from June 18th to the 22nd, and in Brussels from June 24th to the 27th. Seventeen of the Advisory Committees will meet in one or other of these places. Visits have been arranged to engineering works and tours will be made to other places of interest, including the Universal International Exhibition at Brussels, which will include an entensive electrical section. The official preliminary programme is now available in English and French in the form of a 22-page booklet.

Membership of the British delegation is open to members of the electrical committees of the British Standards Institution. A new scheme of registration has been adopted, and those who propose to participate should register through the British National Committee (secretary: Mr. P. Good, B.S.I., 28, Victoria St., S.W.1) before April 15th.

Appointments Vacant

Assistant mains engineer for Eastbourne Electricity Department.

Assistant sub-station attendant for Barking Electricity Department.

(See our classified advertisements.)

Our Personal Column

Electrical men are invited to keep readers of the "Electrical Review" posted concerning their movements

Mr. H. B. Trevor Cox, of Manor Lodge, Hayes, Middlesex, who has been asked by the executive committee of the North-East Derbyshire Conservative Association to stand as National Conservative candidate for the constituency at the next General Election, is the son of Mr. C. H. Cox, who is so well known in the electrical industry as a director of the Edison Swan Electric Co., Ltd., and of Edison Swan Cables, Ltd. From the record of his efforts to gain knowledge of industrial and public affairs in many parts of the world, it is safe to judge that Mr. Trevor Cox, when he carries all before him at the polls, will be one of the best informed of the younger men at Westminster. He was born in 1908, and when he left Eton College in 1927 he went to Hanover to study German, and then to the A.E.G. at Berlin to gain general electrical manufacturing experience. In the autumn of 1928 he spent some time in Canada and at Schenectady, U.S.A., with the International G.E. Co., studying industrial conditions in very large electrical factories. Experience was next gained with well-known export merchants, bankers, and other concerns in Berlin, including work in the Siemens & Halske Service Department, which is responsible for providing all kinds of electrical appliances in East Berlin. Later he spent a year with Unilever, Ltd., in various departments. Travels in other parts of Europe, and the study of business matters at Schenectady, also visits to Cuba, Egypt, Palestine, and elsewhere in search of knowledge calculated to help him in preparing for an industrial and public career, were supplemented by experience in electricity supply with one of the leading London companies in 1933.

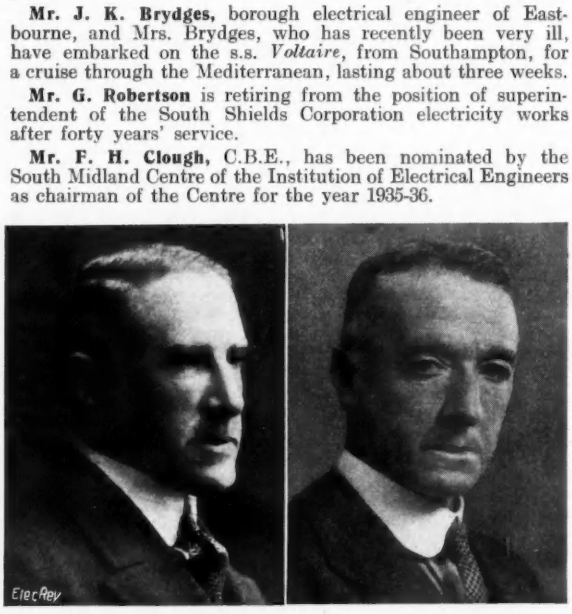
[Elliott & Fry

Mr. H. B. Trevor Cox

Mr. J. K. Brydges, borough electrical engineer of Eastbourne, and Mrs. Brydges, who has recently been very ill, have embarked on the s.s. *Voltaire*, from Southampton, for a cruise through the Mediterranean, lasting about three weeks.

Mr. G. Robertson is retiring from the position of superintendent of the South Shields Corporation electricity works after forty years' service.

Mr. F. H. Clough, C.B.E., has been nominated by the South Midland Centre of the Institution of Electrical Engineers as chairman of the Centre for the year 1935-36.



[C. Ridley Chester *[Elliott & Fry*

Mr. J. A. Hirst (Brookhirst Switchgear, Ltd.) who is the new chairman of the B.E.A.M.A. Council, and Mr. E. S. New (D. P. Battery Co.) vice-chairman

Mr. J. H. Hopton, manager of the Penrith (Cumberland) Electric Supply Co., who is retiring after many years' service, has been presented by his colleagues with an all-mains wireless set. The presentation was made by Mr. F. Armstrong, chairman of the company, and Mr. W. B. Woodhouse, managing director, presided. Tributes were paid to Mr. Hopton, under whose supervision the Penrith Co. was developed until it was merged with the Mid-Cumberland Electricity Co. two years ago.

Mr. Robert Robertson is to receive the honorary degree of LL.D. of the University of Glasgow. Mr. Robertson, who is chairman of the board of governors of the Royal Technical College, Glasgow, commenced his career as a civil engineer in Glasgow, and became the senior partner of Messrs. Strain & Robertson, consulting engineers. He is a director of the Clyde Valley Electrical Power Co. and other concerns.

Mr. A. J. Phillips, installation superintendent with the Huddersfield Corporation Electricity Department, and formerly mains superintendent, is retiring at the end of April after forty-two years' service.

Mr. T. Roles, Bradford City electrical engineer, who has been seriously ill for some weeks, has now almost recovered and has come to the South for a short period of convalescence prior to expected resumption of duty early in April.

Ald. E. Porter, vice-chairman of the Blackburn Electricity Committee, has been appointed a Justice of the Peace for the county borough. Ald. Porter is chairman of the workers' side of the Cable-making Industry, and is vice-chairman of the full Council.

Mr. H. P. Young, M.I.E.E., who is the author of the article on "Scott-connected Transformers," which appears on page 446, is head of the Electrical Power and Machinery Section of the Polytechnic, Regent Street, London. He received his education at the King Edward VI Grammar School and Birmingham Technical College. After his practical training with Messrs. Chamberlain & Hookham, Ltd., Birmingham, he gained experience in the field of electrical power supply in various undertakings in the Midlands and also in London. He joined the teaching staff of the Polytechnic Electrical Engineering Department in 1919.

Elliott & Fry

Mr. H. P. Young

At the annual meeting of the Leicester & County Electrical Club on March 22nd, **Mr. John Mould** was elected life vice-president, **Mr. Joseph Orringe,** president, and **Mr. H. Foster,** chairman of the committee.

Mr. C. M. Fiander, B.Sc., assistant to the chief engineer of the North Wales Power Co., has been appointed sales manager with the Swansea Corporation Electricity Department at a salary of £496 per annum.

Mr. E. A. Gimingham, M.I.E.E., a director of the Edison Swan Electric Co., Ltd., has completed fifty years' service with the company, and the occasion was marked by the presentation of a silver casket from the directors at a board meeting held on March 20th. Mr. Gimingham, who has always been connected with the technical side of the organisation, was closely concerned with the earlier developments of the electric lamp, and it was his brother who actually made the first electric lamp for Sir Joseph (then Mr.) Swan.

Obituary

Mr. J. T. Welch.—The death is announced, at the age of seventy-two years, of Mr. James Thomas Welch, engineer in charge of the power plant of the Braunton Electric Light & Power Co., a position which he had held since the formation of the company in 1912.

Mr. M. B. Clough, chief assistant engineer of the Victoria Falls & Transvaal Power Co., Ltd., has died at Germiston, on the East Rand, at the age of forty-nine. He was born at Bedford, and after serving an electrical engineering apprenticeship he was with the Bournemouth municipal electricity undertaking, and later with the Newcastle-on-Tyne Electric Supply Co., Ltd. He joined the staff of the Victoria Falls Co. in 1910, and was largely responsible for the design of the company's Witbank power station.

Mr. John Warrack, chief electrical assistant to the maintenance superintendent of the Victoria Falls & Transvaal Power Co., Ltd., has died at Johannesburg, at the age of fifty-seven. Mr. Warrack gained his B.Sc. degree in engineering at Glasgow University, and, after being associated with Lord Kelvin, joined the electrical engineering staff of the London County Council as distribution engineer. He went to South Africa to join the staff of the Victoria Falls Co. in 1911. During the greater part of his service with the company he was engaged on electrical maintenance and construction work.

Financial Section

New Companies, Returns of Share Capital, Debenture Charges, Reports of Electrical Companies, Dividend Changes, Transactions in Stocks and Shares

New Companies Registered

Cosmic Radio Services, Ltd.—Private company. Registered March 9th. Capital, £1,500 in £1 shares. Objects: To acquire the business carried on by W. E. Corbett at 23, Water Street, Liverpool, and to act as radio service, electrical, automobile, mechanical and general engineers, &c. The first directors are: W. E. Corbett (permanent managing director and chairman), 311, Highfield Road, Rock Ferry, Birkenhead, and two others. Secretary: Stanley Higson. Registered office: 23, Water Street, Liverpool, 2.

John Bradley (Radio), Ltd.—Private company. Registered March 20th. Capital, £500 in £1 shares. Objects: To carry on the business of electrical and wireless engineers, &c. The subscribers are: G. A. Steedman, 40, Brightwell Crescent, S.W.17, and D. Bullen, 13, Mendora Road, S.W.6. Registered office: 32, Atlantic Road, Brixton, S.W.9.

Caldwell Heater & Battery Charger Patent, Ltd.—Private company. Registered March 23rd. Capital, £1,000 in 1s. shares. Objects: To acquire letters patent, brevets d'invention, rights and privileges, to manufacture and deal in machinery and plant, &c. The subscribers are: R. H. T. Newman, 49, Wray Crescent, Tollington Park, N.4, and E. P. Griffiths, 104, Priory Road, Hornsey, N.8. Registered office: Aldwych House, Aldwych, W.C.2.

Consec Signs, Ltd.—Private company. Registered March 23rd. Capital, £1,000 in £1 shares. Objects: To acquire all the rights and interests of the inventor for and in an invention relating to improvements in or relating to electromagnetic switches particularly for flashing signs, and to carry on the business of motor, electrical, radio and general engineers, &c. C. J. Ievers, Granville Hotel, St. Margaret's Bay, Kent, is one of the first directors.

Christie & Ewer, Ltd.—Private company. Registered in Edinburgh March 18th. Capital, £1,500 in £1 shares. Objects: To acquire the business of motor and electrical engineers and dealers carried on by Christie and Ewer at Canal Street, Saltcoats, and also the business of radio and electrical engineers carried on by them as the Radio Supply Company at Glencairn Street, Saltcoats. The first directors are: R. Christie, 18, Christie Gardens, Saltcoats, and three others. Secretary: James Kirkland. Registered office: Canal Street, Saltcoats.

Savoy General Supplies, Ltd.—Private company. Registered March 21st. Capital, £250 in £1 shares. Objects: To carry on the business of dealers in radio and television receivers, apparatus and accessories, gramophones, records, electrical installations and apparatus, domestic electrical appliances, &c. The directors are: R. M. Griffiths, 34, Idlecombe Road, S.W.17; and T. J. E. Manning, 2, Calverley Road, Stoneleigh, Ewell, Surrey. Registered office: Barnard House, 42, Maiden Lane, Southampton Street, W.C.2.

M. & M., Limited.—Private company. Registered March 19th. Capital, £2,000 in £1 shares. Objects: To carry on the business of manufacturers of and dealers in wireless sets, television sets and apparatus, &c. The first director is H. Davis, 80, City Road, E.C.1.

Rientor Enterprises, Ltd.—Private company. Registered March 19th. Capital, £1,500 in £1 shares. Objects: To acquire the business of wireless apparatus and material manufacturers and dealers in electrical goods now carried on by F. L. Groves and R. S. Newman, as "Frederick Groves," at 644, High Road, Leytonstone, E.11. The directors are: M. Lyons, 90, Broomfield Avenue, Palmers Green, N.13, and T. J. C. Scott, 41, Navarino Road, Hackney, E.8. Secretary: F. J. Tidmarsh. Registered office: 26, Budge Row, Cannon Street, E.C.4.

Returns of Electrical Companies

Veritys, Ltd.—Capital, £196,000 in 7,000 5 per cent. preference and 7,000 6 per cent. preference shares of £10, 7,000 preferred ordinary shares of £7 10s., and 70,000 deferred ordinary shares of £1. Return dated December 25th, 1934. All shares taken up. £137,701 10s. paid (£10 per share on 4,670 5 per cent. preference and 7,000 6 per cent. preference, £7 10s. per share on 2,800 preferred ordinary and 1s. per share on 30 deferred ordinary). £58,298 10s. considered as paid (£10 per share on 2,330 5 per cent. preference, £1 per share on 4,200 preferred ordinary, and 1s. per share on 69,970 deferred ordinary). Mortgages and charges: £122,454.

C.B.O., Ltd.—E. G. Richardson, 45, London Wall, E.C., was appointed receiver on March 7th, 1935, under powers contained in debenture dated July 21st, 1933.

Neonbar Signs, Ltd.—R. A. P. Barton, 1, Albert Road, Wimbledon Park, S.W.19, ceased to act as receiver on March 15th, 1935.

Underground Electric Railway Co. of London, Ltd. (in liquidation).—A memorandum of satisfaction in full on July 10th, 1934, of trust deed dated October 15th, 1928, and deeds supplemental thereto dated March 31st, 1930, and November 10th, 1930, and registered October 19th, 1928, April 1st, 1930, and November 13th, 1930, respectively, securing £6,750,000 debenture stock, was filed at Somerset House on March 14th, 1935.

Metropolitan Electric Tramways, Ltd. (in liquidation).—Satisfaction in full on December 19th, 1934, of trust deed dated April 28th, 1904, and deed supplemental thereto dated May 28th, 1906, and registered May 18th, 1904, and June 13th, 1906, respectively, securing £600,000 debenture stock, has been notified. (Notice filed March 14th, 1935.)

Tamworth District Electric Supply Co., Ltd.—Issue on March 8th, 1935, of £5,000 debentures, part of a series already registered.

Berry Trust Co., Ltd.—The nominal capital has been increased by the addition of £500 beyond the registered capital of £5. The additional capital is divided into 10,000 ordinary shares of 1s. each.

Shirebrook Electric Supply Co., Ltd.—Capital, £5,000 in £1 shares. Return dated November 1st, 1934. 4,800 shares taken up. £4,162 10s. paid (£1 per share on 2,800 and 15s. per share on 2,000 shares). £137 10s. calls unpaid. Mortgages and charges nil.

Woodfyt Sales, Ltd.—Capital, £2,550 in 1,000 preference and 1,550 ordinary shares of £1. Return dated December 24th, 1934. 758 preference and 205 ordinary shares taken up. £963 paid. Mortgages and charges nil.

Nivalight (1928), Ltd.—Capital, £5,000 in £1 shares. Return dated November 23rd (filed December 12th), 1934. All shares taken up. £5,000 paid. Mortgages and charges nil.

"Ohm Sweet Ohm" Electrical Appliances, Ltd.—The nominal capital has been increased by the addition of £300 beyond the registered capital of £200. The additional capital is divided into 600 ordinary shares of 10s.

Frank Raworth, Ltd.—Capital, £3,000 in £1 shares. Return dated November 30th, 1934. 2,222 shares taken up. £2,022 paid, £200 considered as paid. Mortgages and charges nil.

George H. Scholes & Co., Ltd.—Capital, £8,000 in 5,000 preference and 3,000 ordinary shares of £1. Return dated December 21st, 1934. 4,482 preference and 3,000 ordinary shares taken up. £5,096 paid on 4,096 preference and 1,000 ordinary shares, £2,386 considered as paid on 386 preference and 2,000 ordinary shares. Mortgages and charges nil.

Allbright Electric Co., Ltd.—The nominal capital has been increased by the addition of £4,000 in £1 shares beyond the registered capital of £1,000.

British Ipso Battery Co., Ltd.—G. Gain, 53, New Broad Street, E.C., ceased to act as receiver and manager on February 18th, 1935.

Electrical Manufacturing & Plating Co., Ltd.—Capital, £300 in £1 shares. Return dated December 31st, 1934. 300 shares taken up. £300 considered as paid. Mortgages and charges nil.

Wholesale Lamp Co., Ltd.—Particulars filed of debentures not exceeding £300 authorised February 18th, 1935, charged on the company's property, present and future, including uncalled capital, the amount of the present issue being £150.

Rotor Electric, Ltd.—Particulars filed of debentures not exceeding £480, authorised February 4th, 1935, charged on the company's property, present and future, including uncalled capital, the amount of the present issue being £380.

Selfix Electric Co., Ltd.—Capital, £1,000 in £1 shares. Return dated December 24th, 1934. 691 shares taken up. £335 paid, £356 considered as paid. Mortgages and charges nil.

Chiswick Electricity Supply Corporation, Ltd.—Satisfaction in full on or before January 20th, 1909, of 4½ per cent. first debentures authorised by resolutions of November 2nd, 1900, and March 8th, 1901, and registered May 1st, 1901, securing £50,000. (Notice filed March 16th, 1935.)

City Notes

The Midland Electric Corporation for Power Distribution, Ltd., held its annual meeting on March 26th, when Mr. G. H. Nisbett (chairman), who presided, said that the increase of 30 per cent. in the sales of electricity represented a satisfactory increase in revenue, notwithstanding the fact that the discount from the standard charges to consumers had been increased from 10 to 20 per cent. During the year nearly £168,000 was spent in extensions of the distribution system. The change-over from d.c. to a.c. in Wednesbury was proceeding satisfactorily, and should be completed during the current year. The record of increase in consumers, in load connected, and in extensions of the distribution system showed wide margins over their previous best, and 1935, so far, was maintaining the same measure of progress. This increased volume of work had necessitated a revision of the whole system of administration. They had concentrated their distribution, maintenance, and meter departments at Ocker Hill. The buildings acquired had been adapted to deal with the increased volume of stores, and for maintenance departments previously carried on at Wednesbury. Extensions to the offices were in course of erection, together with a new test room and meter department. They had also revised the staff dealing with new services and consumers' inquiries in the various districts, and their area had been marked out into twelve districts, each under the supervision of a resident district engineer. New sub-stations were in course of erection or completed at Stowheath, Willenhall, Wednesfield, Sedgley, Lye, and Womburn. The demand for additional industrial load was such that the existing feeder mains would be quite unequal to the load next winter. They had decided to run two large ring mains, one to the southern section and the other to the northern section of their area. These ring mains would operate at 33,000 V and, normally, be fed by the West Midlands J.E.A. (from whom they purchased their electricity) at Ocker Hill, and they had an emergency feed connection from the Wolverhampton station. This additional provision should meet their requirements for the next five years. Orders had been placed for the cables, switchgear, and transformers, and it was hoped to have them in commission in August next. It was their practice to lay mains by their own staff, but the volume of other work in hand was such that these new cables were being laid by British Insulated Cables, Ltd., under contract to complete 2,000 yds. per week. The capital commit-

ments now in progress exceeded £200,000 in value. It was proposed to increase their nominal capital from £1,000,000 to £1,150,000 and to issue a bonus to ordinary shareholders in the proportion of one new ordinary share for every three ordinary shares held. This issue had been approved by the Electricity Commissioners, but it was anticipated that future capital requirements would have to be met by loan issues carrying relatively low interest rates. They had met immediate requirements by a temporary loan of £100,000, but further loan provision would have to be arranged before the end of the year to meet the heavy capital expenditure upon work in hand.

British Insulated Cables, Ltd., held its annual meeting on March 26th, Sir Alexander Roger (chairman) presiding. In presenting the report and accounts (ELECTRICAL REVIEW, March 22nd, page 437), the chairman said that the improvement in the net trading profit was largely due to increased turnover, achieved in the face of growing and intense competition in important classes of their manufactures, by reason of which the rate of gross profit obtainable had decreased. They had recently installed at their Prescot works a plant for the manufacture of their own gas, of which they used large quantities for process heating. A further addition to their manufacturing facilities had been made by the erection and equipment of a new workshop for house service electricity meters. This had been designed ultimately to augment their output by 300 per cent. They specialised in the manufacture of all sizes of electric resistance welders, the demand for which had so increased that they had reorganised their manufacturing facilities and were now able to meet the most exacting requirements. The copper, lead, aluminium and other metals used annually in their factories amounted to over 60,000 tons, and last year the Helsby works easily broke all its previous records of output. Their subsidiary company, British Copper Refiners, continued to do well and last year showed a substantially increased output and considerably increased profit. They were now handling nearly one-third of the whole copper used in this country for electrical purposes, and had duplicated the plant to provide against breakdown. They continued to devote attention to research and to the improvement of works technique, in which they co-operated with others and from which they reaped great benefit in improved methods of manufacture and consequently lower costs in the face of lower prevailing selling prices (due to increased competition). Had this co-operation not been achieved, they would have had a much less satisfactory profit and loss account. The increase of 14 per cent. last year in the sales of electricity and of 112,396 in the number of telephone users pointed clearly to the better purchasing power of the people and the general improvement in the country's position over the period. With regard to the future, the amount of unexecuted orders they had in hand at the beginning of the current year was considerably better than that of the previous year, and the prospects at the moment pointed to a continuance of activity. The renascence of business in this country was a tender growth, and it had not yet extended to other countries in which their interests had been considerable, and he hesitated to hold out greater hope than that this year might be as good as 1934.

Telegraph Construction & Maintenance Co., Ltd.—Speaking at the annual meeting on Tuesday, the chairman (Mr. C. F. Campbell) said that to strengthen the board by the inclusion of someone with a thorough knowledge of metal manufacturing and industrial concerns Sir Arthur Balfour had been appointed a director. The reduction in the debit balance on the trading account showed that they were working in the right direction and he believed that this year, when the power cable factory would be in operation for the full period, and with further economies, they would be able to work once again without loss. More submarine cable had been made during the past year than in 1933 but the prices were still on the low side. The tendency had been for cable companies to pick up and renovate their cables rather than replace them but this was a very inadvisable practice. There was a prospect of the extended use of gutta-percha cables in submarine telegraphy. Owing to delay in receiving sanction for the buildings from the L.C.C. the power cable branch did not get into proper working order until last July, but in spite of this and highly competitive prices they were able almost to cover expenses and the results for the first two months of this year had been satisfactory. Their power cables had already earned a high reputation and they expected the works to be fully occupied during this year. Their insulating material "Telconax" was being used in broadcast relay work and they had manufactured a large quantity of aerial and other types of wire. The consumption of their special alloys was increasing. They were asking the shareholders to approve the enlargement of the company's powers by alterations in the memorandum of association. Sir Geoffrey Clarke (managing director), in seconding the resolution for the adoption of the report, said that so long as there were 350,000 miles of submarine cable laid the company could look forward to a proportion of the work. Even the renewal of 1 per cent. would give them sufficient profitable work for their factory.

The Bournemouth & Poole Electricity Supply Co., Ltd., reports a net revenue for the year ended December 31st last of £165,616, as compared with £155,992 for 1933, which with £16,225 brought in makes £181,841. After deducting debenture interest, &c., and transferring £45,000 to reserve for depreciation, renewals, &c., it is proposed to maintain the ordinary dividend at 15 per cent. for the year, being a final distribution of 9 per cent., and to carry forward £16,500. The sales of electricity totalled 33,739,100 kWh, as against 29,123,385 kWh in 1933, and the number of consumers increased by 4,994 to 37,054. The company has acquired the Milton and Barton-on-Sea (Hants) Electricity Supply Co., Ltd., and has also acquired further shares in the Swanage Gas and Electricity Co., in both cases by an exchange of shares. The Swanage and District Electricity Special Order, 1934, authorising the transfer of the Swanage undertaking to the company, has received Parliamentary approval. During the year reductions were made in charges and the assisted wiring and hire-purchase schemes were extended. Progress has been maintained in changing over the system to standard frequency, and it is anticipated that it will become possible to close down the Bourne Valley power station during the current year. During the year supply has been made available at Stoborough, Upton, Bear Wood, Burton and Merley. The new central offices and showrooms at Bournemouth were completed during the year. Meeting: April 2nd.

The Lancashire Electric Light & Power Co., Ltd., held its annual meeting on March 26th, when Mr. G. Balfour (vice-chairman), who presided, said that the increase in sales of electricity during the first half of the year was nearly 12 per cent. greater than for the first half of 1933, but for the second half-year the increase was only 4 per cent. The total advance was fairly satisfactory, but the benefit had been absorbed in increased expenses. Directions had been received from the Central Electricity Board for the installation of an additional 50,000-kW turbo-alternator with the necessary boiler plant and extensions to buildings. During the year they acquired the undertaking of the West Lancashire Rural District Council, covering an area of 51 sq. miles and serving a population of 11,443. A supply in bulk was given to the Formby U.D.C. on July 15th. They had improved their showroom accommodation and obtained a site for new showrooms and offices at Chorley. They had considerably extended their activity in connection with assisted wiring and hiring and hire-purchase of apparatus, having considerably added to the number of cookers, water heaters, &c., connected. Last year they generated or purchased 405,200,000 kWh, and after allowing for the quantity "exported" to the Central Board, the kWh delivered to their own mains amounted to 335,200,000, the sales totalling 304,000,000 kWh, an increase of 22,500,000 as compared with the previous year. During the year 5,011 additional consumers were connected, and in addition they added 1,356 consumers on taking over the West Lancashire undertaking. The total number connected to date was 34,771. A total of seventy-three miles of h.p. lines had been laid during the year, bringing the total to 707 miles, and additions to l.p. mains were 119 miles, making a total of 765 miles.

The Mersey Power Co., Ltd.—Presiding at the annual meeting on March 26th, Mr. H. J. Falk (chairman) said that the industrial districts in their area had been recovering gradually from depression, while domestic consumption had grown rapidly and farmers were beginning to appreciate the value of electrical power. The number of consumers increased during the year from 13,249 to 17,275, and the number of cookers connected increased by more than 60 per cent. Eleven new sub-stations had been added, making 127. The number of premises connected in the three districts were respectively 72 per cent., 67 per cent., and 48 per cent. The two-part tariff and assisted wiring had proved successful, consumers on the former having increased by nearly 50 per cent., and on the latter by nearly 74 per cent. Their total sales, including the bulk supply to Mid-Cheshire Co., were 57,935,916 kWh, as compared with 50,798,378 in 1933.

The Clyde Valley Electrical Power Co. held its annual meeting on March 26th. Mr. C. Ker (chairman), who presided, said the sales of electricity during the year under review totalled 281,000,000 kWh, an increase of 25,000,000 kWh as compared with the previous highest figure (1929). Domestic supplies had shown a progressive increase, and the domestic load connected had doubled during the past five years. During 1934 the industrial demand had shown marked improvement, especially shipbuilding and engineering. Substantial reductions, approximately 10 per cent., had been made from the beginning of 1934 in the standard power and domestic tariffs. These reductions cost them about £63,000. The extent of their authorised area was 1,243 sq. miles, much of which was not suitable for electrical development. This meant heavy outlay on cables to distant places, but with the exception of three districts into which supplies had been recently introduced all their customers received electricity on the standard terms and conditions. Last year they added 17,548 h.p. to their connections, and consumers increased by 24,000 to 94,000. With regard to prospects, the curve showing the trend of the power demand, while still upward, was tending to flatten out. The domestic load was rising satisfactorily, and was likely to do so for some time. A 30,000-kW set was to be installed at Clyde's Mill power station to be ready for service for the coming winter. It was the present intention to have a further unit ready for service for the winter of 1937-38, but the question of the size and the situation of the unit had not yet been decided.

The British Aluminium Co., Ltd., reports a net profit for 1934 of £389,178, as compared with £318,856 in 1933. After providing for debenture interest, taxation, &c., it is proposed to pay a dividend of 7½ per cent. on the ordinary shares (the amount payable on the new ordinary shares calculated according to the terms of the issue is £2 5s. 6d. per cent.), less tax, and to carry forward £55,375. The dividend for 1933 was 5 per cent. In June the authorised capital was increased from £2,400,000 to £4,500,000 by the creation of £800,000 preference and £1,300,000 ordinary shares. In the same month £500,000 preference and £998,966 ordinary shares were issued at a premium. At the same time £3,500,000 4 per cent. mortgage debenture stock was created, of which £1,000,000 was issued and the balance reserved for the conversion or replacement of the then existing £2,500,000 5 per cent. first mortgage debenture stock. Notice of redemption of the latter stock was given and any stock outstanding as at January 1st, 1936, will be redeemed at that date. The tonnage of aluminium sold during the year was somewhat greater than in the previous year, but importation, particularly of rolling mill products at low prices, continued, mainly with the help of foreign subsidies.

Associated Electrical Industries, Ltd., reports a profit for 1934 of £586,882, as compared with £397,169 in the preceding year, and after deducting debenture interest, depreciation, &c., and adding £102,615 brought in, the profit available is £127,859 (against £286,813). A sum of £10,289 is placed to general reserve, making a total of £900,000, and the ordinary dividend for the year is 6 per cent. (against 3 per cent.), leaving £113,336 to be carried forward. The report states that the trading results reflect the improved conditions which have prevailed during

the year. The output from the various works of the group was greater than in previous years, and orders received during the year, as well as orders in hand at December 31st last, showed a considerable increase over those for 1933. The directors have decided to redeem the outstanding £1,036,353 4 per cent. mortgage debenture stock. This will be repaid out of liquid resources. Meeting: April 4th.

Enfield Cable Works, Ltd.—Presiding at the annual meeting on March 21st the Earl of Verulam (chairman), in the course of his speech, said that the improvement noted in the latter half of 1933 was maintained throughout 1934. There had been no special direction in which improvement had shown itself; every department had been slightly busier than in 1933. Competition was, however, as keen as ever, because the aggregate capacity of the cable factories of this country was very far from being fully engaged in production to-day. They were restoring the dividend, which had been reduced to 20 per cent. for 1933, to 25 per cent. for 1934. Regarding the prospects for the current year, political unsettlement at home and abroad and the state of the exchanges acted as a constant brake upon a business such as theirs, and it might be that in 1935 they would not do much better than they did in 1934. They were hopeful, however, that they would do at least as well; January and February had come up to expectations.

The Chelsea Electricity Supply Co., Ltd., held its annual meeting on March 21st, when Mr. W. R. Davies (chairman), who presided, said that there had been considerable criticism of the charges for electricity in their area of supply. The critics invariably based their complaints on the flat rate charge of 5d. per kWh for lighting. This charge was the maximum rate. The average price at which they sold electricity was no more than 2.43d. per kWh. Of the sales 60 per cent. were to consumers on the two-part tariff at an average price in 1934 of 1.84d. per kWh. With regard to the London Associated Electricity Undertakings scheme, the directors felt that a closer co-operation with other London companies would yield better results. A common policy should facilitate expansion and tend to standardise prices, pressures and frequencies, and so meet one of the chief complaints of their critics. The directors therefore recommended acceptance of the scheme.

The Scottish Power Co. reports that the trading profits for 1934 of undertakings owned and operated by the company, together with interest during construction of the Grampian Company's hydro-electric works, was £498,932, as against £444,305 for the preceding year, and after paying tax, £453,324 (£404,521). Of this amount an aggregate of £127,827 was reserved or carried forward in the accounts of the undertakings. The accounts of the holding company show a net profit of £300,844 (against £269,366). It is proposed to pay a final ordinary dividend of 5½ per cent., maintaining the distribution for the year at 8 per cent., and to carry forward £7,827 (£7,683). The report states that since the close of the year 30,000 ordinary shares of £1, fully paid, have been issued in settlement of the purchase price of the whole issued share capital of the Elgin Electric Supply Co. Meeting: March 29th.

The Brompton & Kensington Electricity Supply Co., Ltd., held its annual meeting on March 21st. Mr. W. R. Davies (chairman), in the course of his speech, said that their sales increased by 924,000 kWh over 1933, but the amount carried to net revenue was £3,132 less, although their gross receipts were £6,613 more. This was mainly due to the increased cost of electricity purchased from the London Power Co. Their business continued steadily to increase. They connected 667 new consumers, 200 of whom had adopted the two-part tariff. The flat rate was 5d. for lighting and 1d. for power, whereas the price under the two-part tariff averaged 1.52d. The proposed merger of six London supply companies was a move in the right direction, and was necessary for the development of the industry. He advised shareholders to approve the exchange of shares without delay.

The International Automatic Telephone Co., Ltd., reports a profit for 1934 of £97,757, as compared with £87,351 in the preceding year. To this is added £77,824 brought in, making £175,581. As we have already announced the ordinary dividend for the year is maintained at 8 per cent., and £78,031 is carried forward. The report states that although the year opened with a good range of orders for the principal products of the Automatic Electric Co. (its manufacturing subsidiary), it was not until the latter half of the year that a satisfactory output was accomplished. The joint trading activities of the company and the Automatic Electric Co., showed improvement when compared with the preceding year. Meeting: March 29th.

Thomas Bolton & Sons.—The subscription list was to open yesterday (Thursday) for an issue of £400,000 of 4½ per cent. first mortgage debenture stock at par. The issue is being made through the Telephone and General Trust. The stock has been created for the primary purpose of redeeming the outstanding 6 per cent. first mortgage debentures at 104 on October 1st and of providing cash for the repayment of moneys owing to the company's bankers.

The South London Electric Supply Corporation, Ltd., reports a revenue for 1934 of £103,991, as compared with £95,832 for 1933. After deducting debenture interest, &c., and placing £43,265 to sinking fund, it is proposed to maintain the ordinary dividend for the year at 7 per cent. and to carry forward £25,658. The sales of electricity totalled 41,943,970 kWh, an increase of 886,756 kWh, and the number of consumers 23,953, an increase of 3,974.

The Anglo-Portuguese Telephone Co. reports a net profit for 1934 of £79,412, as against £70,618 for 1933, to which is added £33,702 brought in, making £113,114. The final ordinary dividend is 5 per cent., making 8 per cent. for the year (same), and a dividend at the rate of 8 per cent. per annum is paid on the new ordinary shares, while the "A" ordinary shares also receive 8 per cent. The balance carried forward is £23,258. Meeting: April 22nd.

The Richmond (Surrey) Electric Light & Power Co., Ltd., reports a profit for 1934 of £32,484, which with £1,435 brought in makes £33,919. After deducting sinking fund instalment and transferring £8,000 to reserve for depreciation, renewals, &c., it is proposed to pay a final ordinary dividend of 7 per cent., making 11 per cent. for the year, and to carry forward £2,438. The sales of electricity totalled 8,107,349 kWh, as against 6,242,861 kWh in the preceding year. Meeting: April 2nd.

The South Metropolitan Electric Light & Power Co., Ltd., reports a net revenue for 1934 of £197,070, as against £151,556 in the preceding year. After providing for interest, depreciation, taxation, &c., it is proposed to maintain the ordinary dividend for the year at 9 per cent., and to carry forward £39,166. The sales of electricity increased by 22,142,607 kWh to 97,785,400 kWh. Meeting: April 2nd.

The Woking Electric Supply Co., Ltd., reports a profit for 1934 of £50,532, which with interest (£9,222) and £1,639 brought in makes £61,393. A final dividend of 5 per cent. is paid on the ordinary shares, making 10 per cent. for the year, tax free, £21,000 is placed to depreciation and renewals fund, and £6,500 to reserve. A balance of £1,692 is carried forward. Meeting: March 29th.

The Cambridge Electric Supply Co., Ltd., reports a balance on net revenue account for 1934 of £58,532, including £3,265 brought in. It is proposed to place £10,000 to general reserve and to pay a final ordinary dividend of 4 per cent., making 8 per cent. for the year. The balance carried forward is £8,532. Meeting: April 3rd.

Waste Heat & Gas Electrical Generating Stations, Ltd., reports a profit for the year ended January 31st last of £30,123, as against £28,821 for the previous year, which with £26,614 brought in makes £56,737. The reserve receives £4,624, and the dividend for the year is 8 per cent. (same), £26,513 being carried forward.

The Dublin United Tramways Co. (1896), Ltd., reports a net profit for 1934 of £85,676 (against £77,040 in 1933). It is proposed to pay a final ordinary dividend of 2 per cent., making 3 per cent. for the year, to set aside £20,000 towards renewal of the permanent way, and £20,000 to mortgage and debenture redemption fund, leaving £17,127 to be carried forward.

The Tamworth District Electric Supply Co., Ltd., reports a profit for 1934 of £14,686. After providing for income tax, placing £5,150 to depreciation reserve, and adding £1,601 brought in there is a balance of £10,887 available. It is proposed to pay a final ordinary dividend of 4 per cent., making 6 per cent. for the year, and to carry forward £1,887.

The Bath Electric Tramways report a net profit for 1934 of £11,492 as against £11,326 in 1933. It is proposed to pay a dividend of 4 per cent. on the preferred ordinary shares and to carry forward £1,075.

The Edison Swan Electric Co., Ltd., reports a net profit, after providing for debenture interest, etc., of £23,036 for 1934, as compared with a loss of £25,935 for 1933. The ordinary dividends are resumed with a payment of 6 per cent., and £15,648 is carried forward.

The Oxford Electric Co. reports a profit for 1934, including £5,069 brought in, of £30,036. The ordinary dividend for the year is maintained at 7 per cent., and £6,036 is carried forward.

The Marconi International Marine Communication Co. has announced a final dividend of 5 per cent., maintaining the distribution for the year at 7½ per cent.

The Montreal Light, Heat & Power Consolidated has announced a quarterly dividend of $0.37 on the common shares (same).

Stocks and Shares

TUESDAY EVENING.

POLITICS hold the predominant hand in the matter of Stock Exchange prices and business. At the beginning of the week the visit of Sir John Simon to Berlin drew all eyes to the Continent, displacing for the moment the anxiety that had been felt previously in regard to the probable action of Belgium in connection with the gold standard. Belgium has reiterated her intention of maintaining, with France, Switzerland and other gold countries, her position in the gold bloc. It is thought that circumstances, however, may yet prove too strong for the Belgian resolution, and, in consequence, investment and speculation alike are bending their mental energies to foresee in what direction a desertion of the gold standard by Belgium might lead Stock Exchange prices.

The gilt-edged list is unsettled and disturbed, prices being materially lower than they were six or seven weeks ago. The decline which has taken place has so far passed over the Central Electricity, London Passenger Transport, and the securities of other Electricity Boards. It may be that the prices, though nominally unchanged, would be more difficult for a seller to obtain if he wished to realise at the present time, but the fact remains that the nominal prices have scarcely varied.

Home Railway Heaviness

London Passenger Transport "C" stock is a point down at 97. Home Railway stocks as a whole have suffered rather sharply, on the announcement that an appeal to the House of Lords was to be made against the favourable rating decision given to the Southern Railway last month. That decision led to a rise in the prices of all Home Railway stocks, but the uncertainty as to what may transpire, as a result of the coming appeal, caused the improvements to be largely lost. At a N.U.R. meeting, held on Sunday last, one of the speakers declared that if the four railway companies are unable to

bring their system up to date—he was referring more particularly to electrification—then the natural corollary is public control.

Electricity Supply Shares

The fall in prices in the home electricity supply group has been stayed. The list has settled down to a lower basis of quotation, and, of course, a higher level of yield. At the current prices, the return on the money from the ordinary shares of the best-class London Electricity supply companies is 4¼ per cent., comparing with barely 3⅜ per cent. in the earlier part of the year. The fall has been due to a variety of political and financial considerations, and is no more than proportionate to the declines suffered by gilt-edged and investment securities of most descriptions. The companies' reports for 1934 have been regarded, on the whole, as a little disappointing. The progress made with setting up the London Associated Electricity Undertakings suggests that the dividends will be standardised at 7 per cent. in the case of the companies agreeing to the plan, as to the desirability of joining which there has been a certain amount of discussion. Sufficient support has been obtained, however, to enable the scheme to be carried through, and in due course it will doubtless become operative.

Provincial and Overseas

West Gloucestershire ordinary at 85 is 1½ lower, and Edmundson's ordinary at 42s. are also a trifle down. The preference have shaded off to 35s. North Eastern Electric ordinary have gone back to 30s. 6d. and Yorkshires to 42s. 6d. In the London group, Westminsters at 33s. 6d. are 6d. harder. The reports of the Bournemouth, South Metropolitan and South London Electric companies show good expansion. The meetings of the three companies take place on the same day, Tuesday in next week, April 2nd. Amongst foreign companies' shares, Palestine ordinary have gone back to 10s. 9d. premium. In the Indian group, Calcuttas are a trifle easier at 62s. Small falls have lowered Atlas to 5s., British Power and Light to 23s.

Amongst the electricity supply ordinary shares whose prices were quoted ex dividend on Monday in this week are Bournemouth and Poole, Brompton, Lancashire, Midland Corporation, Richmond (53s. 3d.), Scottish and South London.

Cable and Wireless

Following the general course of markets, Cable and Wireless stocks have given way to a moderate extent. The 5½ per cent. preference at 82 shows a fall of 2. The "A" ordinary stock is back to 16¼, the "B" to 5¾. These falls have had no effect on the prices of Globe Telegraph and Trust shares. Great Northern Telegraphs at 39 are 10s. lower in consequence of the uncertainty felt in regard to the Continental outlook. Marconi Marines have lost a florin, at 32s. 6d. The utility group is moderately steady; American Telephone and Telegraph at 107 recovered a point of its recent fall, but Internationals are dull at 6¾. No fresh development has occurred during the past few days in the position as it relates to American utilities. The hold of President Roosevelt upon the respect of his fellow-countrymen does not seem to be increasing, and it may be that his proposed campaign against the utility companies may give way to a form of expression less antagonistic to the interests of the shareholders in these undertakings. The Anglo-Portuguese Telephone Company has announced a final dividend, making 8 per cent. for the year, the usual rate. Profits show an increase The ordinary shares are quoted at 29s. xd.

Manufacturing and Equipment

Associated Electrical Industries has justified the favourable expectations formed of its probable dividend by declaring 6 per cent. for the year, double the rate paid for the previous twelve-month. The profit rose nearly £190,000, and also is £140,000 above the profit for 1932. In 1932 the dividend was 4 per cent., in 1933 it was 3 per cent., and now it is 6 per cent. In more normal markets than those which prevail at present, the figures would undoubtedly have had a favourable effect, but as things are now, the announcement went almost unheeded, and the price of the shares at 24s. 6d. ex dividend is a shade lower on the week, allowing for deduction of dividend. The British Thomson-Houston report makes a good showing; the total assets are returned as £6,384,000, an increase of £180,000. The company's 7 per cent. preference shares are quoted in the Stock Exchange, and stand at 28s. 9d. Arons have been down to 63s., but recovered to 63s. 9d. General Electric preference weakened to 30s. Henleys at 6 1/16 are 1/16 easier. British Aluminium shares at 30s. 6d. are ex the dividend of 7½ per cent., which compares with 5 per cent. paid for 1933.

Rubber shares rose sharply on Tuesday in this week upon the decision to "cut" the exportable quota to 70 per cent. for the coming quarter, April-June inclusive, and to 65 per cent. for the rest of this year. Rubber jumped to 6d. per lb., after being 5½d. a few days earlier. Share prices followed suit. There was a good deal of noisy excitement in the Stock Exchange market when the announcement became known. Iron and steel shares have been dull on fears of Belgian competition. Base metal shares, including those in copper-producing companies, have advanced, by reason of anticipation in the market that the prices of the metals concerned will be advanced.

Share List of Electrical Companies

HOME ELECTRICITY COMPANIES.

	Nom.	Dividend 1934.	Dividend 1933.	Price. Mar. 26.	Rise or Fall.	Yield. p.c. £ s. d.
Bournemouth and Poole	1	15	15	76/3xd	—	3 18 9
Brompton Ordinary	1	7	7	33/–xd	+6d.	4 4 10
Charing Cross Ordinary	1	7	7	33/–	—	4 4 10
Chelsea	1	7	7	33/–	—	4 4 10
City of London	1	7½	7½	36/6	—	4 2 2
Clyde Valley	1	7	8	41/6	–6d.	3 17 2
County of London	1	10½	10½	54/–	–1/–	3 17 9
Edmundson's 7% Pref.	1	7	7	35/–	–1/–	4 0 0
Elec. Dis. Yorkshire	1	9	9	46/–	—	3 18 3
Elec. Supply Corporation	1	11	—	56/3	–¼	3 18 5
Kensington Ordinary	1	7	7	33/6	—	4 3 7
Lancs Light and Power	1	7	7½	36/–xd	—	4 3 4
London Electric	1	7	8	38/–	—	3 13 8
Metropolitan	1	10	10	49/6	–6d.	4 1 0
Midland Counties	1	7	7	35/–	–6d.	4 0 0
Mid. Elec. Power	1	8	8	51/3xd	—	3 2 6
North Eastern Electric Ordinary	1	6	6	30/6	—1/6	3 18 8
Do. 7% Pref.	1	7	7	34/6	+6d.	4 1 2
Northampton	1	10	10	52/6	—	3 16 4
Notting Hill 6% Pref.	10	6	6	14	—	4 5 9
North Met. Elec. Ordinary	1	10	10	58/3	–1/3	3 8 9
Do. do. 6% Pref.	1	6	6	31/–	—	3 17 5
St. James and Pall Mall	1	7	8½	33/6	—	4 18 6
Scottish Power	1	8	8	42/–xd	—	4 0 0
South London	1	7	7	35/6xd	—	3 17 9
Westminster Ordinary	1	7	7	33/6	+6d.	4 3 7
Whitehall Elec. Invst. 7½% Pref.	1	7½	7½	26/3	—	5 14 1
Yorkshire Elec.	1	8	8	42/6	–6d.	3 15 5

PUBLIC BOARDS.

Central Electricity, 1950–70	Stock	5	5	115	—	4 7 2
Do. 1955–75	„	5	5	117	—	4 5 6
Do. 1951–73	„	4½	4½	111	—	4 1 1
Do. 1963–93	„	—	3½	101	—	3 9 6
London & Home Counties, 1955–75	„	4½	4½	114	—	3 19 0
London Passenger Transport, A	„	—	4½	121½	—	3 14 0
Do. do. B	„	—	5	124½	—	4 0 4
Do. do. C	„	3	—	97	–1	3 1 10
West Midlands Joint Elec. 1948–68	„	—	5	116	—	4 6 2

TELEGRAPH AND TELEPHONE.

		1932	1933			
American Tel. & Tel.	$100	9	9	107	+1	8 8 2
Anglo-Am. Tel. Pref.	Stock	6	6	117½xd	—	5 2 2
Do. Def.	„	1½	1½	28	—	5 7 2
Cable & Wireless 5½% Pref.	„	2¾	2¾	82	–2	3 7 1
Do. A. 7½% Ord.	„	Nil	Nil	16½	—1	—
Do. B. Ord.	„	Nil	Nil	5¾	–½	—
Globe Tel. & Tel. Ord.	10	Nil	2½	11¼	—	2 3 7
Do. do. Pref.	10	6	6	13½	—	4 10 7
Great Northern Tel.	10	20	20	39	–½	5 2 7
Marconi-Marine	1	10	7½	32/6	–2/–	4 12 4
Oriental Telephone Ord.	1	12	12	3⅛	—	*3 12 5

HOME AND FOREIGN TRAMS, ETC.

Anglo-Arg. Trams First Pref.	5	Nil	Nil	2/–	—	—
Do. do. 2nd Pref.	5	Nil	Nil	1/6	—	—
Do. do. 5% Deb.	Stock	Nil	Nil	5	—	—
British Electric Traction Df. Ord.	„	5	5	885	—	—
Do. do. Pref. Ord.	„	8	8	165½	–2½	4 17 0
Brazil Traction	100	—	—	9½	—	—
Brit. Columbia Elec. Rly. Pfe.	Stock	5	5	102½	—	4 17 6
Mexican Light Common	100	Nil	Nil	1½	—1	—
Do. 7% Pref.	100	7	7	4½	—	—
Do. 1st Bonds	$500	5	5	40	—	—
Victoria Falls Ord.	1	15	20	7½	–½	2 16 0
Yorkshire (West Riding)	1	2½	5	28/9	—	3 9 9

MANUFACTURING COMPANIES.

Aron Electricity Ord.	1	10	10	63/9	–½	3 3 0
Assoc. Elec. Ord.	1	4	6	24/6xd	–9d.	4 18 0
Do. Prf.	1	8	8	37/–	—	4 6 4
Babcock & Wilcox	1	9	6	43/9	–3d.	2 14 10
British Aluminium Ord.	1	5	7½	30/6xd	—	4 18 4
British Insulated Ord.	1	5	15	75/–xd	–1/–	4 0 0
Brush Ord.	Stock	Nil	Nil	37½	—	—
Callender's	1	15	15	3½	—	4 5 9
Do. 6½% Pref.	1	6½	6½	32/6	—	4 0 0
Crompton Parkinson Ord.	5/–	22	12½	35/6	—	1 15 0
Do. 8% Pref.	1	8	8	36/3	—	4 8 5
Edison-Swan 1st Pref.	1	7½	7½	27/6	+⅛	5 9 1
Electric Construction	1	Nil	Nil	15/–	—	—
Enfield Cable Ord.	1	25	20	4½	—	5 2 6
English Electric	1	Nil	Nil	6/9	—	—
Do. do. Pref.	1	Nil	Nil	12/6	—	—
Ever Ready	5/–	35	35	22/9	—	7 13 10
Ferranti Pref.	1	7	7	29/6	—	4 15 0
G.E.C. Perf.	1	6½	6½	30/–	–⅛	4 6 8
Do. Ord.	1	8	8	48/3	—	3 6 7
Henley's	1	30	30	6 11/16	–⅛	4 8 0
Do. 4½% Pref.	5	4½	4½	5½	—	3 16 8
India-Rubber Preferred	1	—	5½	1¼	—	4 17 9
Johnson & Phillips	1	5	5	28/3	—	3 10 8
Siemens Ord.	1	6½	4	1	—	4 0 0
Telegraph Construction	£1	Nil	Nil	1½	+½	—

* Dividends paid free of Income Tax.

Published Specifications

Compiled expressly for this journal by a firm of chartered patent agents. The numbers in parentheses are those under which the specifications will be printed and abridged and all subsequent proceedings will be taken.

1933

15753. "Television apparatus." H. Knudsen. May 31st, 1933. (424763.)

17985. "Electrolytic condensers." Ruben Condenser Co. April 29th, 1933. (424831.)

18329. "Control of grid-controlled valves." Akt.-Ges. Brown, Boveri & Cie. June 27th, 1932. (424832.)

18692. "Thermal time switch for controlling electric heating apparatus for buildings." R. Maclaren and R. Maclaren & Co., Ltd. July 1st, 1933. (424833.)

20621. "Cathode-ray tubes." J. L. Baird and Baird Television, Ltd. July 21st, 1933. (424632.)

20622. "Television or like systems." J. L. Baird and Baird Television, Ltd. July 21st, 1933. (424633.)

20876. "Magnetic cores." Kinzoku Zairyo Kenkyusho. April 8th, 1933. (424765.)

23181. "Current-collector mechanisms for electrically-propelled vehicles." M. F. L. A. Aymard. August 19th, 1933. (Cognate application 21756/34.) (424636.)

23356. "Television and/or like systems." A. C. Banfield and Baird Television, Ltd. August 22nd, 1933. (424887.)

23379. "Securing of electric insulators upon their pins or supports." H. Hoffmann and W. J. Van der Bilt. August 22nd, 1933. (423637.)

23386. "Television and photograph transmission systems." T. Makashima and K. Takayanagi. August 22nd, 1933. (424773.)

23463. "Electric cable end-sleeve." J. H. Op Den Velde. September 2nd, 1932. (424640.)

23617. "Electrolytic condensers." Elektrizitäts-Akt.-Ges. Hydrawerk. January 7th, 1933. (424840.)

23681. "Cathode-ray tubes." Fernseh Akt.-Ges. September 1st, 1932. (424690.)

23697. "Electrical conductors." Allgemeine Elektrizitäts-Ges. August 25th, 1932. (424776.)

23727. "Electrical speed indicators and revolution counters." W. G. Bird. August 26th, 1933. (424642.)

23857. "Thermionic amplifiers suitable for use in radio and like receivers." Telefunken Ges. für Drahtlose Telegraphie. August 26th, 1932. (424779.)

24021. "Metallic trunk-conduit systems for electric cables." W. G. W. Shaw. August 30th, 1933. (424842.)

24028. "Modulating and amplifying devices in wireless-valve circuits." W. L. Watton and L. H. Bainbridge-Bell. August 30th. 1933. (424783.)

24070. "Luminescent or fluorescent screen structures for use in cathode-ray tubes and the like." Marconi's Wireless Telegraph Co., Ltd. August 30th, 1932. (424893.)

24094. "Process for the manufacture of electric discharge devices." British Thomson-Houston Co., Ltd., and J. A. V. Fairbrother. August 30th, 1933. (424787.)

24205. "Converting arrangements comprising induction coils." R. C. Watkins and G. H. Stiles. August 31st, 1933. (424648.)

24213. "Thermionic valves." Telefunken Ges. für Drahtlose Telegraphie. August 31st, 1932. (Addition to 17440/33.) (424792.)

24315. "Lightning arrestors." J. B. Hansell and Associated Electrical Industries, Ltd. September 1st, 1933. (424846.)

24452. "Terminal structures for electric cables." Okonite-Callender Cable Co., Inc. September 2nd, 1932. (424649.)

24857. "Metallic vapour and gaseous electric discharge devices." P. Freedman. September 7th, 1933. (424895.)

25317. "Electricity measuring instruments." A. Page. September 13th, 1933. (424654.)

25866. "Telekinematographic and like systems and apparatus therefor." W. W. Jacomb and Baird Television, Ltd. September 19th, 1933. (424657.)

27442. "Coils for electrical purposes." Westminster Tool & Electric Co., Ltd., and G. R. Hook. October 5th, 1933. (424662.)

28162. "Electromagnetic relays." General Electric Co., Ltd., and W. R. Rose. October 12th, 1933. (424795.)

28302. "Electrical measuring instruments." H. A. Stevenson. October 13th, 1933. (424694.)

29357. "Directional aerials." E. C. Cork and E. L. C. White. October 23rd. 1933. (424698.)

29610. "Thermionic-discharge tubes or valves." E. Y. Robinson and Associated Electrical Industries, Ltd. October 25th, 1933 (424699.)

30040. "Electrical heating devices for chicken brooders." J. Mudd. October 30th, 1933. (424700.)

30170. "Radio receiving sets employing automatic volume control." E. K. Cole, Ltd., and G. Bradfield. October 31st, 1933. (424702.)

30221. "Supply or control of power in electric traction systems." General Electric Co., Ltd., and C. C. Garrard. October 31st, 1933. (424664.)

30938. "Illuminated signs." Claude-General Neon Lights, Ltd., and L. A. Archibald. November 7th, 1933. (424705.)

32556. "Electric incandescent filament lamps of tubular form." H. Mayer. November 21st, 1933. (424708.)

32735. "Wireless receivers." A. Spiwak. November 23rd, 1933. (424910.)

33290. "Radio and like receivers." Marconi's Wireless Telegraph Co., Ltd. November 25th, 1932. (424711.)

33583. "Thermionic cathodes." Ferranti, Ltd., and G. P. Easten. November 30th, 1933. (424912.)

33788. "Light-diffusing glasses." General Electric Co., Ltd., and S. S. Beggs. December 1st, 1933. (424800.)

34460. "Oscillator circuits for superheterodyne receivers." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. January 2nd, 1933. (424714.)

34825. "Dielectric materials for electrical apparatus." British Thomson-Houston Co., Ltd. December 23rd, 1932. (424915.)

1934

636. "Method of activating cathodes in discharge tubes by means of gases or vapours." Elektrische Gluhlampenfabrieken J. Kremenezky Akt.-Ges. January 10th, 1933. ((424721.)

1591. "Arrangements for series operation of rectifying units in polyphase systems." E. Cameron. January 16th, 1934. (424854.)

4911. "Direct-current voltage changers incorporating electron-discharge devices." British Thomson-Houston Co., Ltd. February 15th, 1933. (424728.)

5873. "Electric convertor systems." British Thomson-Houston Co., Ltd. February 24th, 1933. (424859.)

5880. "Trunk communication cables in particular for the transmission of high-frequency currents." Siemens & Halske Akt.-Ges. February 22nd, 1933. (424920.)

9024. "Thermionic amplifiers." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. May 18th, 1933. (424735.)

9425. "Arc-welding apparatus." J. P. Tripp. March 29th, 1933. (424861.)

10097. "Luminous gas electric discharge tubes." H. Hawksby. June 21st, 1934. (424736.)

13283. "Television apparatus." British Thomson-Houston Co., Ltd. May 2nd, 1933. (424743.)

16014. "Magnetic materials." British Thomson-Houston Co., Ltd., June 3rd, 1933. (424746.)

16304. "Directional radio installations." Telefunken Ges. für Drahtlose Telegraphie. May 31st, 1933. (424747.)

18146. "Method of forming an electrode or a contact surface on an electric resistance of semi-conducting materials." Patent Treuhand-Ges. für Elektrische Gluhlampen. July 26th, 1933. (424930.)

19033. "Electric transformer installations." British Thomson-Houston Co., Ltd. June 29th, 1933. (424753.)

22038. "Method of testing current transformers." Dr. W. Hohle. July 28th, 1933. (424810.)

23483. "Clockwork-actuated devices for controlling electric circuits." J. T. Delviniotti. September 5th, 1933. (424942.)

25152. "Resistance welding or heating electrodes." British Thomson-Houston Co., Ltd. August 31st, 1933. (424816.)

26203. "Electric lighting installations." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. September 13th, 1933. (Additon to 389025. (424818.)

27849. "X-ray tubes having an anode adapted to move when in use." C. H. F. Muller Akt.-Ges. September 30th, 1933. (424822.)

28284. "Electricity meters." N. B. Coop and British Electric Meters, Ltd. October 3rd, 1934. (424876.)

Trade Mark Applications

The following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from March 20th:—

Sordoviso. No. 550183. Class 8. Electric devices for use in association with electric bell and lighting systems in buildings so that the lights may give visible warning upon the actuation of the bell system.—A. Cianchi, 72, Greencroft Gardens, Hampstead, N.W.6.

Sollux. No. 555548. Class 11. Luminous heat lamps for curative purposes.—Hanovia, Ltd., 21, Buckingham Avenue, Trading Estate, Slough, Bucks.

Arcoss. No. 552938. Class 13. Electrodes of ordinary metal without a cutting edge, all for use in electric welding.—La Société la Soudure Electrique Autogène, 58-62, rue des Deux Gares, Brussels, Belgium. (British representatives: Boult, Wade & Tennant, 112, Hatton Garden, E.C.1.)

Fraxram. No. 557917. Class 13. Electric lamps (ordinary).—London Electrical Manufacturing Co., Ltd., Lemco Works, Fulham Road, S.W.6.

Mem. No. 556078. Class 16. Electric insulators (porcelain and earthenware).—Midland Electric Manufacturing Co., Ltd., Barford Street, Birmingham.

An Ingenious Calculating Machine

A CALCULATING machine of an unusual kind, known as a differential analyser, which has been installed in the Physics Building of the University of Manchester, was demonstrated on March 27th.

In the application of mathematics to many problems of pure and applied science there occur differential equations which cannot be solved in terms of functions of which tables are available, and yet for which numerical solutions are required.

The differential analyser is designed for the rapid evaluation, by mechanical means, of solutions of a wide range of such equations with an accuracy, generally, of a few parts in a thousand. Its speed of working, accuracy, and range of application are likely to make it an important tool in many diverse lines of research. It can be applied, for example, to calculations in the following fields of investigation: atomic structure and properties; transients in electrical circuits containing elements with non-linear characteristics; propagation of radio waves in the Heaviside layer; motion of a body in a resisting medium, with any law of resistance; and vibrations of systems with non-linear restoring forces.

The original general idea of such a machine is due to Lord Kelvin; the planning and design of a practical and accurate machine is due to Dr. V. Bush, of the Massachusetts Institute of Technology, where the first one was built.

The differential analyser at Manchester, which the University owes to the generosity of Mr. R. McDougall, deputy treasurer of the University, and to the co-operation of Dr. Bush, has been built by the Metropolitan-Vickers Electrical Co., Ltd., and is the first such machine to be constructed outside America, though another is under construction at the Astrophysical Institute, Oslo.

New Work for Contractors

Particulars of new works and building schemes for the use of electrical installation contractors and traders

Publication in this list is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Aberdeen.—Baths; city architect.
Acton.—Two factories, Minerva Road; F. E. Simpkins, architect.
Ashton-under-Lyne.—Houses (42), Smallshaw; borough surveyor. Central school, Springfield Lane, for E.C.; Percy Howard, architect, 88, Mosley Street, Manchester.
Aylesbury.—Block of shops, offices and flats, Brooke House site; Sedgwick, Weall & Beck, architects, Watford.
Ayr.—Maternity home, Heathfield; burgh surveyor.
Banbury.—Hospital (£50,000); Board of Management, Horton Hospital.
Barnsley.—Houses (176); borough engineer.
Bath.—Houses (128), Shophouse Road Estate; city engineer.
Becontree.—Houses (195), L.C.C. Estate (£73,000); R. J. Rowley, Ltd., and Henry Boot & Sons, Ltd.
Bedford.—Swimming baths for Modern School, Clarendon Road; F. Milner.
Bedfordshire.—Installation of electric lighting, Biggleswade Institution, for P.A.C.; county surveyor, Bedford.
Birkenhead.—Churches, Irby and Prenton (£12,000), for the Methodist trustees; circuit secretary.
Blaydon-on-Tyne.—Houses, Lynwood Avenue; G. Browell & Co., builders.
Boreham Wood (HERTFORDSHIRE).—Cinema, for the Tudor Cinema (Elstree), Ltd.
Bournemouth.—Houses (96), Kinson Estate; borough engineer. Hotel, Broadway; Eldridge Pope & Co.
Bridlington.—Dance and concert hall (£28,000) for the Parade and Property Committee.
Brierley Hill.—Houses, Brockmoor, and Kingswinford; U.D.C. surveyor.
Brigg (LINCOLNSHIRE).—Houses (38); U.D.C. surveyor.
Brighton.—Shops and flats, Old Steine; Melville, Dundas & Whitson, Ltd. School, Warmdene Avenue, Patcham (£13,000), for E.C.
Bromley.—Houses (24), George Lane, Hayes; borough surveyor.
Bude.—Church, Killerton Road, electrical work, for the Congregational trustees; Rev. B. A. Millard, pastor.
Cambridgeshire.—Junior school, Fen Ditton, for County E.C.; county architect, Shire Hall, Cambridge.
Chadderton.—Public baths; Taylor & Simister, architects, Oldham.
Chailey (SUSSEX).—Houses (48); R.D.C. surveyor.
Chester-le-Street.—Hotel; P. B. Browne and Sons, architects, Pearl Buildings, Northumberland Street, Newcastle-on-Tyne.
Colchester.—Houses (32), Ipswich-Harwich Road site; city engineer.
Colwyn Bay.—Cinema at the corner of Marine Road and Conway Road, for the Odeon Theatres, Ltd., Cornhill House, Birmingham; H. W. Weedon, architect, 84, Colmore Row, Birmingham.
Coulsdon.—Estate development, Coulsdon Road, for Hill & Seaby, Ltd.; W. J. Llewellyn Horsman.
Coventry.—Houses (110), clearance area (£32,000); city architect. School, Hen Lane, for City E.C.; Kelley & Sons, builders.
Crewe.—Extensions, including women's ward, Memorial Hospital; J. Martin, architect, Westminster Chambers, Nantwich Road.
Croydon.—Extensions to factory, Aurelia Road; Accounting & Tabulating Cpn., Ltd.
Darlington.—Factory, Clarksyard, for J. E. Hodgson; J. E. Chilton, architect, Tubwell Row. Municipal aerodrome; borough engineer.
Denbighshire.—Central schools, Llay, for County E.C.; Alun Edwards, builder, Caergwrle.
Downham.—Shops, Bromley Road and Oakridge Road; A. Frampton.
Dulwich.—Tenements, East Dulwich Estate (£81,200); L.C.C. architect.
Dumfriesshire.—Houses (24), Langlands, Ecclefechan (electrical work), for C.C.; housing architect, Dumfries.
Dundee.—Cinema, Broughty Ferry; Maclaren, Soutar and Salmond, architects.
Dursley.—Houses (120), Kingshill Road; R.D.C. surveyor.
Ealing.—Houses (94), Ferrymead Avenue; Ruddock & Meigham. Houses (106), Sunley Gardens; Dodge & Reid, architects.
Easington.—Houses (274); Hays & Gray, architects, Wingate, Co. Durham.
East Retford.—Houses (36), Lidget Lane and Mount Pleasant Estates; borough surveyor.
Ebbw Vale.—Houses (80), Glyncoed site; Council surveyor.
Edinburgh.—Houses (100), Heriothill Terrace and Claremont Street; James Miller and Partners, Ltd., builders.
Eton.—Houses (28), Somerville Road; U.D.C. surveyor.
Exeter.—Shops, Salters Road; city architect. Swimming pool, Hamlyn Lane; city engineer.
Folkestone.—Houses (69), Hill Road, and Fishmarket area; borough surveyor.
Gatley.—Bank, for Martin's Bank, Ltd.; Hibbert & Penn, builders, Edgeley, Stockport.
Glasgow.—School, Albert School site; Education Director.
Gloucester.—Modernisation of Hippodrome Theatre, for Poole's Theatres, Ltd., proprietors.
Grangemouth.—Houses (76); J. C. Wallace, burgh surveyor, Town Hall.
Gravesend.—Estate development in the vicinity of Thong Lane, Chalk; V. Burr. Extensions to Fairfield Works, Stuart Road; C. E. Wallis & Sons, Ltd.
Great Yarmouth.—Houses (64) and flats; borough engineer.
Halifax.—Houses, Pyenest and Ling Bob, electrical work; D. T. Lloyd Jones, borough engineer.
Holmfirth.—Houses (22) (electrical work); J. Ainley, architect, 25, Market Street, Huddersfield.
Irish Free State.—(Co. WATERFORD).—Technical School, Dungarvan, for County Vocational E.C.; J. Lanigan, chief executive officer, Technical School, Dungarvan.
Kilmarnock.—Maternity home (£21,000); burgh surveyor.
Kirkcaldy.—Houses (332); W. Dow, architect.
Lancashire.—Schools, Formby and Great Crosby, for County E.C.; county architect, Preston.
Leamington Spa.—Houses and shops, Fosse Farm; R. A. C. Churchward, architect, 12, Victoria Street, London, S.W.1.
Leeds.—Houses (1,526); Tarran Industries, Ltd., builders, Hull.
Leicester.—Houses (2,720) and shops, &c., Stocking Farm Estate, Beaumont Leys; A. Whitley, Ltd., 36, Victoria Street, London, S.W.1.
London.—(E.).—Improvements to King George V, Royal Victoria and Royal Albert Docks (£1,750,000); Port of London Authority. (E.C.).—Rebuilding, 5-8, Birchin Lane and 2, Cowpers Court; City of London Real Property Co., Ltd. (PADDINGTON).—Buildings, 3-8, Hyde Park Terrace, and Albion Mews, for Harry Neal, Ltd., 117, Baker Street, W.1; Septimus Warwick, architect. (ST. MARYLEBONE).—Buildings, 97-9, Gt. Portland Street; C. E. Peczenik. (ST. PANCRAS).—Tenements, Ferdinand Place (£31,776); Tarran Industries, Ltd., Hull. (WANDSWORTH).—Block of flats, Wimbledon Park, South; Roy Gibson, Ltd. (WEST KENSINGTON).—Boys' and girls' school (£33,660); Albert Monk, Lower Edmonton, N.9.
Luton.—Houses (22), Chester Avenue, for C. C. Smith. Works extensions, British Gelatine Co., Ltd., New Bedford Road.
Macclesfield.—Houses (34), Moss Lane Estate; M. J. Gleeson, Ltd., builders, Sheffield.
Mansfield.—Rebuilding business premises, Market Place; Waude Thompson, borough engineer.
Middlesex.—Grammar school, Rectory Farm Estate, Hampton, for County E.C. Reconstruction of North Middlesex Hospital, Edmonton (£500,000), for C.C.
Mill Hill.—Hotel, Bypass Road; Ernest Owers, Ltd., Golder's Green, N.W.11.
Monk Bretton (YORKSHIRE).—Cinema, Pontefract Road, for Lundwood Cinema Co., Ltd.; secretary.
Newbury.—Extensions to works; Elliotts of Newbury, Ltd.
Newcastle-on-Tyne.—Houses, Scotswood Estate, Fergusons Estate; R. G. Roberts, housing architect, 18, Cloth Market.
Northolt.—Houses, shops and cinema; Lime Tree Farm Estate; Henry Boot (Garden Estates), Ltd.
Norton (YORKS).—Houses (34); R.D.C. surveyor.
Patcham (SUSSEX).—Houses (44), Friar Road; Sussex Property & Building Co., Ltd. Shops, &c., Old London Road; Haywards (Brighton), Ltd.
Penrith.—Houses (34), Council Estate; U.D.C. surveyor.
Pontefract.—Houses (40), Glass Houghton; Tennant & Smith, architects, Ropergate.
Renfrew.—Houses (74), Porterfield; A. Allon, burgh surveyor, Municipal Buildings.
Salford.—Flats (£64,000), Eccles New Road; William Gornall & Sons, Ltd., builders. Factory, Camp Street and Nelson Street, Broughton, for Joseph Egerton & Co., Ltd.; A. Tomkins, builder, Grecian Street, Broughton, Manchester.
Shirley (BIRMINGHAM).—Factory, for the Chad Valley Co., Ltd., Harborne, Birmingham.
Skelmanthorpe.—Business stores, electrical work, for the Co-operative Society; P. N. Brown, architect, Holmfirth.
Slough.—Houses (318), Upton Lea Estate; Manor Park Construction Co. Postal sorting office, Grove Parade, for H.M. Office of Works, King Charles Street, London, S.W.1.
Smethwick.—Junior and nursery schools (£65,000) and extensions to junior technical college, for Borough E.C.; director of education.
Springhead.—Houses (180), Thornley Estate; F. Thorpe, architect, Union Bank Buildings, Oldham.
Stafford.—Houses (34), Tillington Estate; W. Whittingham, builder, Wolverhampton.
Stockport.—Houses (172), Adswood Hall Farm Estate; borough surveyor.
Stranraer.—Houses (64), Sun Street; J. Mercer, burgh surveyor, Municipal Buildings.
Sunderland.—Additions to premises for Sunderland Gown & Mantle Co.; J. Huntley & Sons, builders, Marion Street. Extension to Bede Collegiate Boys' School; J. Lewis, borough engineer, Town Hall.
Sutton Bridge.—Houses (24); J. T. Merryweather, builder, Spalding.
Teddington.—Studio and dressing rooms, Weir House, for Warner Bros., Broom Road.
Thornton Heath.—Blocks of flats, London Road; Armstrong Estates, Ltd.
Tiverton.—Houses (52), Willand; Housing Committee.
Twickenham.—Flats (270); borough surveyor.
Urmston.—Houses (28), Thornton Estate, near Chassen Road; Ken Moffatt, builder, Glenhaven Estate, Flixton.
Walker-on-Tyne.—Extensions to Walkergate School; Mr. Harvey, Education Offices, Newcastle-on-Tyne.
West Hartlepool.—Extensions to Brougham School; F. Durkin, borough engineer.
Weymouth.—Houses (200); borough surveyor. Municipal offices for Special Corporation Committee.
Whitehaven.—Houses (120), Woodhouse site; borough engineer.
Widnes.—Houses (150), Derby Road Estate; James Holt, borough engineer, Town Hall.
Wolverhampton.—Houses (182), Showell Road, for Manley & Regulus, Ltd.
Wombwell (YORKSHIRE).—Houses (43), Broomhead Road, for A. Dobson.
York.—Aerodrome; city engineer.